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A REVISION OF RAUVOLFIA WITH PARTICULAR REFERENCE TO THE AMERICAN SPECIES*

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Rauvolfia is one of the apocynaceous genera that long has awaited a taxonomic revision. Since the inception of the genus by Plumier[1] in 1703 with two species, the literature has accumulated an abundance of novel specific epithets, based frequently on insufficient material and often due to misconceived synonymy. The 'Kew Index', including all the supplements, lists about 175 names for the world, while the Kew and the Gray Indices together account for about 90 names for the New World alone. An inadequate comprehension of the generic characteristics also has led to the proposal of new genera, such as *Ophioxylon*, *Cyrtosiphonia*, *Dissolaena* and *Heurckia*, to include the Asian and New Caledonian Rauvolfias. Bentham and Hooker correctly recognized the synonymy of these genera with *Rauvolfia*. Plants belonging to other genera, and even other families, in the past have been described as Rauvolfias. Thus Ruiz and Pavon[2] described several species of *Citharexylum*, a genus of Verbenaceae, as species of *Rauvolfia*.

Alphonse de Candolle,[3] in his treatment of Apocynaceae for the 'Prodromus', included 23 species of *Rauvolfia* and, for the first time, provided lists of dubious and excluded species, even though he maintained *Ophioxylon* as a distinct genus. Schumann's[4] much later account for the 'Pflanzenfamilien' recognized about 45 species for the world, but the taxonomic treatment necessarily was brief and sketchy. Pichon[5] estimated about 110 species for the world in a brief synopsis of

[1] Plumier, C. Plant. Am. Gen., p. 19. 1703.
[2] Ruiz & Pavon, Fl. Peruv. et Chil. 2:26. 1799.
[3] A. DC. in DC. Prod. 8:336–342. 1844.
[4] K. Schum. in Engl. & Prantl, Nat. Pflanzenfam. 4^{1-2}:153–154. 1897.
[5] Pichon, M., in Bull. Soc. Bot. Fr. 94:32–39. 1947.

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the genus, and included an analytical key and brief Latin diagnosis of the fourteen sections. Pichon's treatment has badly suffered from the fact that he had not examined more than half the species which he listed. Apart from these, no comprehensive monograph of the genus for the world exists.

As far as the New World species are concerned, the most outstanding account is that of Mueller-Argoviensis.[6] This, however, was limited to about 11 species of Brazil. Markgraf's[7] essay on the relationships of the American Rauvolfias was more comprehensive and included a discussion of the geography and taxonomy of the tropical American species and provided a key to distinguish the species. He recognized 34 species, including 7 new of his own.

Like several other related members of the subfamily Plumeroideae, several species of *Rauvolfia* contain alkaloids of considerable pharmacological importance. The Asian *Rauvolfia serpentina* recently has attained phenomenal publicity in this regard. This naturally has resulted in the extension of interest in these plants to a far wider informed public.

The present revision of the genus in the New World was begun in September of 1954. It is based on a critical study of more than 2,000 herbarium specimens, and also a handful of plants grown in the greenhouse of the Missouri Botanical Garden. Even though the living plants did not yield any statistically significant data, they played a very important role in suggesting the growth and variation pattern of the species concerned.

Fully realizing that the American Rauvolfias are only a small cluster of the world species and cannot therefore be studied entirely by themselves I have given some time to a critical evaluation of Pichon's fourteen sections. I have examined all the specimens which he had for study, and more, although it must be confessed that I too have not been able to examine material for all the species. Any authoritative and detailed presentation of the taxonomy of the extra-American Rauvolfias will have to await more extensive study.

I have reduced the fourteen sections of Pichon to nine, the American Rauvolfias comprising two of these sections and including 34 species, grouped under four series and three subseries.

History of the Genus

The Minim monk and pioneer Caribbean botanist, Charles Plumier, founded the genus *Rauvolfia* in 1703 to commemorate Leonhart Rauwolf, a German drug-plant collector who had widely traveled in the eastern countries. Plumier briefly diagnosed two species: *Rauvolfia tetraphylla angustifolia* and *Rauvolfia tetraphylla latifolia.*

Linnaeus,[8] in adopting the genus, described one species and held another simply as a variety. Thus originated a confusion concerning the identity of the two

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[6] Muell.-Arg., J., in Mart. Fl. Bras. 6[1]:30–34. 1860.
[7] Markgraf, F., in Fedde, Rep. Spec. Nov. 20:111–122. 1924.
[8] Linn. Hort. Cliff. p. 75. 1737.

original species of Plumier. Rendle,[9] who was fortunate in having all the relevant original material at the British Museum, has related the entire story and has ably untangled the complex question of synonymy. The description of *Rauvolfia tetraphylla* in the 'Hortus Cliffortianus' was based on Ehret's drawing of a plant that Linnaeus had seen growing in the Chelsea Garden (pl. 3, fig. 3). Linnaeus wrongly equated this with *Rauvolfia tetraphylla angustifolia* of Plumier and considered Plumier's second species merely a variety. He repeated this error in the first edition of the 'Species Plantarum'. This must have been due evidently to the very brief diagnosis of Plumier on which Linnaeus had to depend in deciding synonymy of his *Rauvolfia tetraphylla.* In 1775 Burmann's edition of Plumier's 'Plantarum Americanarum Genera', containing illustrations of both of Plumier's species, was published (pl. 3, fig. 1). Jacquin, apparently unaware of Burmann's work, published in 1760 three names: *R. nitida, R. hirsuta,* and *R. tomentosa,* and later, in 1763, gave descriptions for them with an illustration for *R. tomentosa* (pl. 3, fig. 2). His *R. nitida* was synonymous with *Rauvolfia tetraphylla angustifolia* of Plumier, and *R. hirsuta* and *R. tomentosa* were conspecific and identical with *Rauvolfia tetraphylla latifolia* of Plumier and *Rauvolfia tetraphylla* of Linnaeus. Apart from Jacquin's illustration of *R. tomentosa,* I have studied a specimen from Jacquin's herbarium at Vienna, annotated in his own handwriting as *Rauvolfia tomentosa,* which proves the correctness of the above dispositions.

The fact that Linnaeus had become aware of his earlier mistake and that he had also seen the descriptions and illustrations of the two species in Burmann's edition of Plumier is indicated in the second edition of the 'Species Plantarum'. In this Linnaeus described *two* species: *Rauvolfia nitida* and *Rauvolfia canescens.* Linnaeus was correct in citing *Rauvolfia tetraphylla angustifolia* of Plumier in synonymy with *Rauvolfia nitida,* and *Rauvolfia tetraphylla latifolia* of Plumier with *Rauvolfia canescens.* In establishing this new name he did not realize that it was conspecific with his earlier *Rauvolfia tetraphylla.*

Jacquin's *Rauvolfia hirsuta* was allegedly based on the reference to the same specimen of Patrick Browne on which Linnaeus based his *R. canescens.* Hence it is a just cause for surprise as to why Linnaeus should have ignored Jacquin's prior name, even if he had considered the Patrick Browne specimen (pl. 3, fig. 4) distinct from the one of Ehret's drawing on which his *R. tetraphylla* was founded. The Linnaean name *R. tetraphylla* has priority over Linnaeus' later name of *R. canescens,* and is the equivalent of Plumier's second species *Rauvolfia tetraphylla latifolia. R. nitida* of Jacquin is equivalent to Plumier's first species *Rauvolfia tetraphylla angustifolia.*

Another question of some concern is that of orthography. Plumier used the Latin version of Rauwolf's name and called the genus *Rauvolfia.* The fact that Rauwolf himself was inconsistent about the spelling of his name, once spelling it Leonhardt Rauwolff and at another time Leonhard Rauwolf, should not concern us

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[9] Rendle, A. B., in Proc. Linn. Soc. Lond. 149:106. 1937. This contains references to all the pertinent literature.

very much here. Linnaeus himself was faithful to the original spelling in all his editions of the 'Genera' and the 'Species Plantarum'. However, Burmann[10] had used three different spellings in quick succession, even in the same page, thus: *Rawolfia*, *Rauwolffia*, and *Rauwolfia*. In the seventh edition of Linnaeus' 'Genera Plantarum' under Reichard, the name was spelled *Ravwolfia* in the text and *Rauwolfia* in the index. The eighth edition under Schreber used *Rauwolfia* and thereafter Willdenow, Alphonse de Candolle, Bentham and Hooker, and Schumann have all used the altered spelling.

Woodson,[11] who at first used the original spelling and later came to prefer the "corrected" spelling of *Rauwolfia*, recently has recounted the story of inconsistency in the spelling.[12] In that account, however, he has clearly indicated that though the spelling *Rauwolfia* is contrary to the requirement of the International Code of Nomenclature, yet he preferred the altered spelling in view of popular usage in that form and particularly because the publication was meant for non-botanical readers.

As mentioned earlier, the spelling *Rauwolfia* transgresses Article 82 of the International Code of Botanical Nomenclature.[13] In this work the original spelling of Plumier, *Rauvolfia* has been consistently used.

Morphology and Anatomy

Habit: Plants of *Rauvolfia*, except *R. purpurascens* of Panama, which Standley has described rather incredibly as a vine, are undershrubs, shrubs, or trees. Most of them are moderately good-sized shrubs, only a few being either puny undershrubs or big trees. The smallest one, appropriately named *R. nana*, of northern Rhodesia in Africa, attains a height of only 15 cm.

Amongst the American species, almost all species belonging to section Rauvolfia are shrubs scarcely exceeding a height of about 2 m. The majority of species of section Macrovolfia, on the other hand, are sturdier and more robust shrubs or trees. *R. linearifolia* is the smallest, hardly reaching a height of 5 dm. Amongst the arboreal species, *R. praecox* is the tallest, reaching a height of about 30 m. Most of the other species have an intermediate habit that can be described at times as shrubs, and at other times as trees.

All the plants are lactescent, particularly in the aerial parts. In *R. tetraphylla*, *R. littoralis*, and *R. serpentina*, roots at any stage of their growth have failed, in my experience, to show latex exudation, when cut. But all the other parts above the hypocotyl exude a milky latex on wounding.

Branches: Branching is usually whorled, often rather densely so. The branches are usually terete, rarely angular or even winged to some extent, as in the African

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[10] Burmann, J., Plum. Plant. Am. Gen. p. 252. 1755.
[11] Woodson, R. E., in Ann. Mo. Bot. Gard. 17:3. 1930; in N. Amer. Flora 29^2:134–138. 1938.
[12] Woodson et al. *Rauwolfia:* Botany, Chemistry and Pharmacology. Little, Brown & Co., Boston. In press.
[13] Int. Code Bot. Nomencl. p. 43. 1952.

R. macrophylla. Except in several species of section RAUVOLFIA, where the young twigs are variously pubescent, the branches are glabrous, and in most species lenticellate to varying degrees.

Nodes: The nodes are emphatically marked by the pectinate glands that usually are present in the leaf axils, as well as by leaf scars. Except in members of series LATIFOLIAE of section MACROVOLFIA, where the terminal nodes are very short and condensed, unlike the more distantly spaced nodes further down, the nodes of all the species are fairly evenly and distantly spaced. However, a condensation of the terminal nodes is evident also in *R. sellowii*, a member of series ANGUSTIFOLIAE. A similar situation exists in the Hawaiian species and in the African *R. macrophylla* and *R. caffra.* This condensation of the terminal nodes, often accompanied by foliage only at the tips of twigs, gives a characteristic appearance to these species.

Leaves: The leaves are whorled, the number in a whorl being variable in different species and sometimes even in the same species. There is also an inconsistency in the shape, size, and indument of the leaves, even in the same species. In spite of this, leaves offer some fairly reliable characteristics for the taxonomic diagnosis of the different species.

The leaves of a given whorl are more or less anisophyllous. They are petiolate or sessile, simple, entire, and ovate, elliptic, lanceolate, obovate, or oblanceolate in outline. The venation is pinnately reticulate, the secondary veins and the vein network extremely variable in clarity on the two surfaces. The secondary veins are mostly arcuate and often unite at the margins to form a marginal vein. However, in species such as *R. nitida, R. sarapiquensis*, and *R. pentaphylla* the secondary veins are transverse or almost so.

The leaves are either membranaceous or coriaceous. All the species included in section RAUVOLFIA have membranaceous leaves, whereas the species in the other sections have leaves of variable texture, from membranaceous to coriaceous. The two surfaces usually are opaque, but in species such as *R. cubana, R. salicifolia, R. praecox*, and *R. nitida*, the upper surface is lustrous and the lower opaque. Though there is a certain amount of difference in the emphasis of the green color on the two surfaces, the upper being usually dark and the lower varying shades of light green, and although Markgraf[14] has used this as a key character, my experience with fresh and dry leaves of identical species has shown that no reliance can be placed on this character. The leaves are glabrous except for some species of section RAUVOLFIA, where one or both surfaces exhibit pubescence to varying degree.

The leaves are variable in size. Like certain species of Asia and New Caledonia, the three Cuban species, *R. cubana, R. salicifolia*, and *R. linearifolia*, have rather narrow leaves, the last having the narrowest leaves of all the species. With the exception of a few species which may possess rather narrow leaves at times, most of the species have comparatively broad leaves.

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[14] Markgraf, F., in Fedde, Rep. Spec. Nov. 20:113–118. 1924.

The petiole varies considerably in length. In most of the species it is short and becomes obscured by the gradual decurrence of the lamina. In *R. praecox* and *R. sellowii*, however, the leaves have fairly long and quite distinct petioles. The petiole usually is entirely glabrous, but in species of section RAUVOLFIA it has also either a sparse or dense glandular covering.

Stipules and Glands: As in other members of Apocynaceae, the nodal region in *Rauvolfia* is marked by a distinctive ring, and the leaf axil is provided with a number of pectinate glands. There has been some difference of interpretation of the nature of these glands. The two observers holding diverse opinions on this score, Woodson and Pichon, have based their conclusions on an observation of more extensive material than was possible for me. Woodson[15] has held, following Gluck's original interpretation, that these appendages are "doubtless in the category of stipules". Pichon,[16] in a lengthy discussion of the stipules and glands of

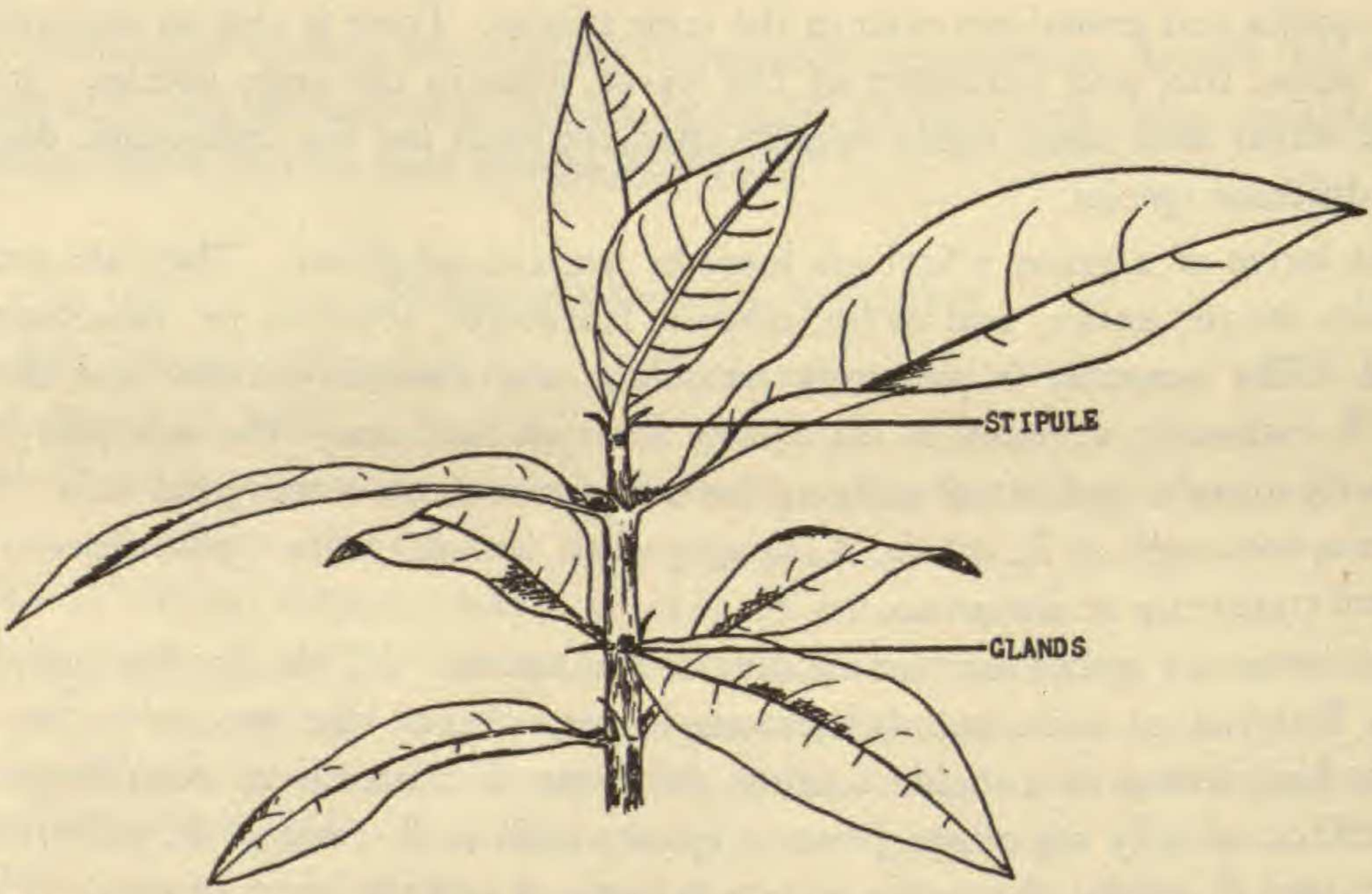

Fig. A. *Rauvolfia littoralis.* Twig showing stipules and glands.

Apocynaceae, has concluded that the glands are in the nature of foliar appendages "*sui generis*" and are distinct from the stipules. There is an obvious lacuna in our knowledge of the morphology and physiology of these glandular appendages.

I have studied the nodal region in living plants of *R. tetraphylla*, *R. littoralis*, and *R. serpentina* with special interest. In the first two species, in addition to the numerous pectinate glands in the leaf axils as well as on the petioles, there are distinct stipules at each node. These stipules are interpetiolar in position, subulate or linear, and are about 2 mm. long. They are deciduous and leave a minute scar on the node (text-fig. A). In *R. serpentina*, the leaf axil does not exhibit many glands, but lateral to the petiole minute subulate structures are clearly observable which are obviously stipules. I have noted similar interpetiolar stipular structures,

[15] Woodson & Moore, in Bull. Torr. Bot. Club 65:148. 1938.
[16] Pichon, M., in Bull. Mus. Nat. d'Hist. Nat. II Ser. 1:467–473. 1949.

in addition to the ubiquitous glands, in young shoots of *R. cubana* preserved in alcohol. Furthermore, in all members of series LATIFOLIAE, there are prominent, deciduous bud-scales which obviously are stipular structures. In *Rauvolfia* at least, examination of both the glands and the stipules leads to the conclusion that the two appendages, although associated, are distinct.

Inflorescence: The inflorescence is terminal. There is no recent discussion in the literature on the position of the inflorescence either in *Rauvolfia* or any of its close relatives in the family. However, some observations and interpretations have been made in certain genera of the allied family Asclepiadaceae. Bugnon,[17] in a study of the inflorescence in *Gomphocarpus fruticosus*, summarized the three principal views on the position of the inflorescence. The three views are: (1) The inflorescence is a sympodium. (2) The inflorescence is an axillary branch. (3)

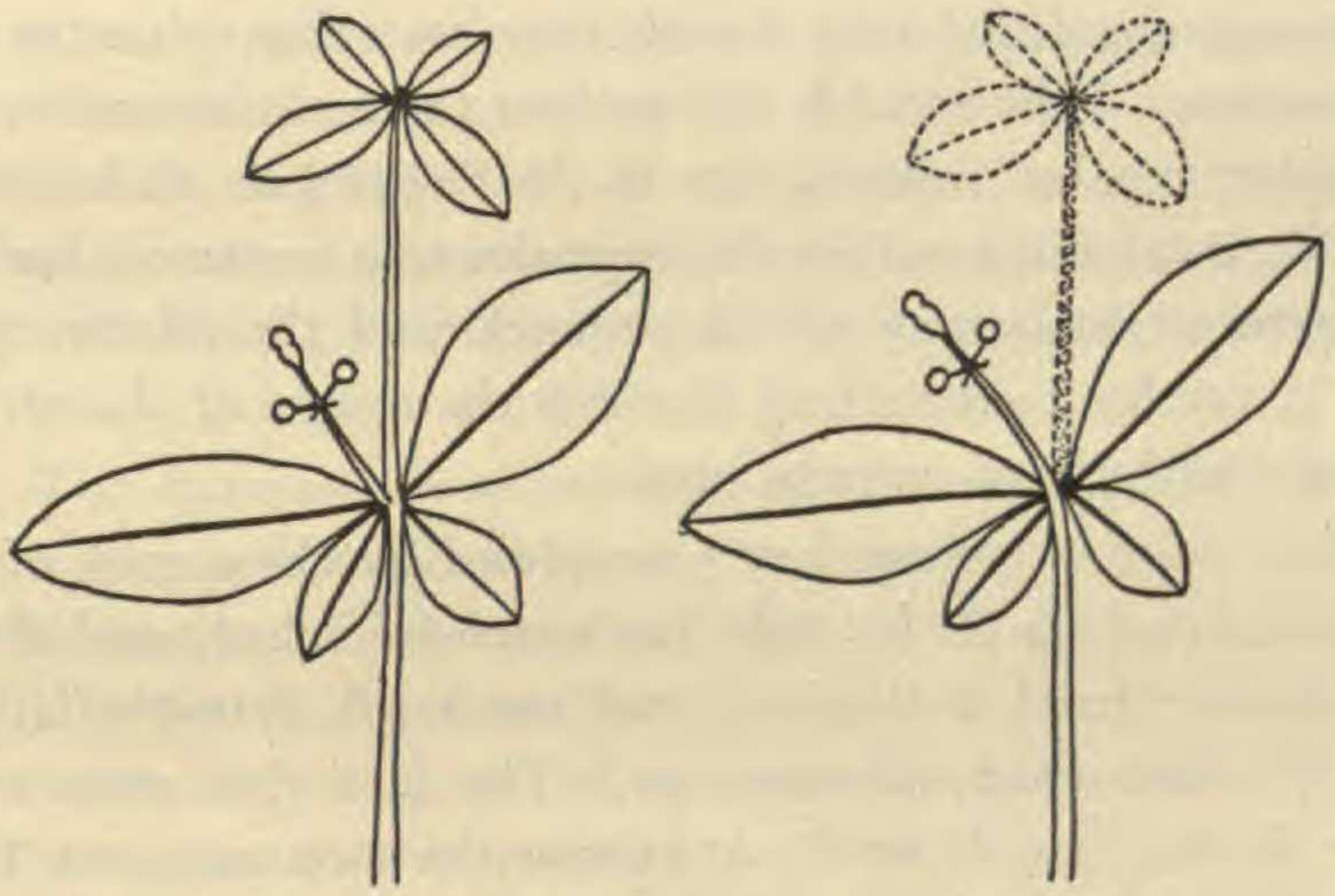

Fig. B. *Rauvolfia tetraphylla.* Inflorescence as it appears (left), and as it is interpreted (right).

The inflorescence is one branch of a dichotomy. On the basis of his studies, Bugnon has rejected all three views and has put forward a rather ambiguous interpretation of his own. Holm,[18] on the other hand, in his studies on the inflorescence of species of *Sarcostemma*, has preferred the classical interpretation of Payer and others, and has held the inflorescence to be a sympodium.

I have studied carefully the development of the inflorescence in living plants of *R. tetraphylla.* The vegetative shoot sooner or later ends in a simple dichasium. By the time the terminal flower-bud is ready to blossom, one of the axillary buds in the subjacent leaf whorl becomes active and soon develops a vigorous shoot. In this process the originally terminal cyme is gradually pushed to one side and the axillary shoot increasingly veers to assume a terminal position (text-fig. B). The inflorescence thus becomes interpetiolar in position after this spatial transposition. Holm has pointed out that the lateral sliding of the inflorescence of *Sarcostemma*

[17] Bugnon, F., in Bull. Soc. Bot. Fr. 102:105–114. 1955.
[18] Holm, R., in Ann. Mo. Bot. Gard. 37:485–486. 1950.

occurs alternately at successive nodes and as the result the inflorescences appear to be in two rows. In *R. tetraphylla*, however, the situation is further complicated by the leaves being in whorls of four. There is no constancy or visible pattern in the order in which axillary buds at any given node develop, or the relationship of the inflorescence to any one axillary bud in the whorl. Commonly, however, only one of the axillary buds in the whorl is developed, be it associated with a smaller or a larger leaf. Yet occasionally two, three, or even all four axillary buds develop, in which case the terminal nature of the inflorescence is left in no doubt whatever. Although these observations have been made in only the living plants of one species, a careful study even of herbarium material of the rest of the species confirms the view that the inflorescence is primarily terminal.

The most generalized type of inflorescence in *Rauvolfia* is the dichasium. Woodson,[19] in a discussion of the inflorescences of Apocynaceae and their phylogenetic significance, concluded that a reduction has taken place in the originally complex inflorescence. This trend is also evident in the inflorescence of *Rauvolfia*. The most complex type of inflorescence is the "aggregate dichasium". A wide range of variation is exhibited within this type alone, in numerous species, by differences in the degree of branching of the peduncle and the relative proportions of the branches. A further contributing factor is the nature of the ultimate cymule, which may be umbelliform or corymbiform.

The reduction trend is perhaps best exemplified by the species of section RAUVOLFIA. A species such as *R. littoralis* has much-branched, multiflorous inflorescences. On the other hand, a closely related species, *R. tetraphylla*, possesses few-flowered, mostly unbranched inflorescences. The fact that even within a single species such as *R. tetraphylla* or *R. ligustrina* the two extremes from a much-branched, multiflorous, to an unbranched, pauciflorous condition is not uncommon contributes further to the idea of reduction in the evolution of the inflorescence. Incidentally, much value was formerly attached to the inflorescence patterns as key characters, but the variation noticed in this study renders them valueless. A pauciflorous inflorescence is also present in species such as *R. macrantha* and *R. paucifolia*, both belonging to the essentially pluriflorous section MACROVOLFIA.

The peduncle in different species is variable in length and in degree of branching. It is usually glabrous, but in the species of section RAUVOLFIA, it may be variously pubescent.

The pedicel is usually distinct and of varied length. In some of the African and Asian species, however, it is much reduced or often even wanting.

Flower: As in the other genera of Apocynaceae, the flower in *Rauvolfia* is regular, bisexual, tetracyclic, and pentamerous, usually pedicellate, rarely sessile as in some African and Asian species. It is relatively small, except in several species of sections MACROVOLFIA, OPHIOXYLON, and OPHIOXYLANTHUS. In several species the flowers often exude a pleasant odor.

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[19] Woodson, R. E., in Ann. Mo. Bot. Gard. 22:1–42. 1935.

Calyx: The calyx is usually green, synsepalous, and mostly campanulate with the lobes usually imbricate in aestivation. The lobes vary considerably in size, shape and texture. In all the American species they are considerably shorter than the corolla. They are ovate to lanceolate in shape, with the apex varying from acute to obtuse or rounded. They are eglandular within and usually glabrous without, except in section RAUVOLFIA where the calyx is variously pubescent without. In some species of section MACROVOLFIA, they are either ciliate or glandular-dentate at the margin.

Corolla: The corolla is sympetalous and of varied shapes: urceolate, campanulate, salverform, or infundibuliform. It is usually white, but some of the species show either lilac or rosy hues or are even variously spotted.

The corolla-tube is generally cylindrical, sometimes constricted at the throat, and sometimes dilated. It is usually glabrous without and variously pubescent within. The extent of pubescence in the tube, the relative proportion of the tube to the corolla-lobes, on the one hand, and to the calyx-lobes, on the other, and the region of constriction and dilatation, all offer fairly reliable taxonomic criteria.

The corolla-lobes are sinistrorsely contorted in aestivation. They are ovate, obovate, elliptic or oblong in outline with acute or obtuse apices. In species of section ENDOLOBUS, the apices are inflexed in the bud.

Stamens: The stamens are epipetalous, five in number and fairly uniform in all the species. The anthers are ovate, acute or apiculate, and slightly varying in size in different species. They are free from each other and the stigma. The thecae are fully fertile and enclose free spherical or subspherical, triculpate pollen grains. The connective in species of sections MACROVOLFIA, OPHIOXYLON and OPHIOXYLANTHUS appears to be projecting in the form of a conical hump on the dorsal surface of the anther, just at the point of attachment with the filament. There is a distinct filament in all the species, though it may vary in length from species to species.

Pistil: The pistil is superior, bicarpellary, the ovary being variously syncarpous or apocarpous. The ovary is of various shapes: globose, cylindrical, ovoid or obovoid. Each locule encloses one or two anatropous ovules, on an axile or ventral placenta.

The style is simple, linear or columnar, glabrous except in the African *R. vomitoria*, where it is villous at the base.

The stigma-head is prominent and variously shaped: depressed-capitate, calyptriform, tympaniform or sub-mitriform. Miers[20] was the first to use the term "clavuncle" to describe the stigma-head of Apocynaceae. The stigma-head possesses a basal ring or collar, a contracted or expanded median region, and a distal indusium encircling the biapiculate apex. Pichon has used the term "strophium" to indicate the median region of the stigma-head. Much of the variation in the shape of the stigma-head in the several species is brought about by a difference in the relative de-

[20] Miers, J. Apoc. S. Am. p. 2. 1878.

velopment of the three regions and the presence or absence of hairy induments on them. I have noticed in *R. tetraphylla* a frequent clustering of masses of pollen grains around the base of the apiculate tip and in the depression formed by the distal indusium, an observation in consonance with that of Miers. However, it is not possible to conclude from this observation whether the depression itself is truly receptive or if it is the apiculate tip that is so. As there is some confusion in the precise use of the term "clavuncle", I have preferred to use the simpler term stigma-head.

The shape of the stigma-head differs with the age of the flower and becomes distorted in the pressed herbarium specimens. This renders the use of the stigma-head valueless as a taxonomic character.

The disc is annular or cupuliform, usually shorter than the ovary which it encircles. It is usually entire.

Woodson,[21] in an elaborate study of the floral anatomy of 39 genera and 60 species of Apocynaceae, commented on the inconsistency in the vascular pattern, particularly in the calyx of *R. nitida* (referred to as *R. tetraphylla* in that paper). He also pointed out the carpelloid nature of the disc or nectary.

In a taxonomic treatment it is not my intention to digress in an account of the floral anatomy. However, I was able to make a few observations concerning flower-buds of *R. tetraphylla* and *R. cubana* which Dr. Woodson had kindly preserved for me. After a study of whole cleared mounts, hand and microtome sections of flower-buds of these two species, no inconsistency in the vascular pattern of the calyx was observed. In both there is a ring of five sepal traces, each of which gives off two lateral traces just prior to entering the calyx-lobe. The corolla and the stamens each have a typical and consistent vascular pattern. The traces to the disc emerge as branches of traces going up to the two carpels, bearing out the carpelloid nature of the disc. Also, I could find no evidence for Boke's[22] interpretation of the corolla-tube as being partly receptacular in origin.

Fruit: The fruit of *Rauvolfia* is a drupe. It is variously syncarpous or apocarpous. The calyx is persistent on the fruit in all the species and the pedicel tends to become stouter in the fruit. The fruit is comparatively small, syncarpous and globose in all species of section RAUVOLFIA. In the species of other sections, however, it is rather large and variously syncarpous or apocarpous. The biggest fruit is that of the Amazonian *R. paraensis*, about 40 mm. in diameter, while the smallest perhaps is that of the Bahian *R. blanchetii*, about 6 mm. in diameter.

The fruit is either rounded or somewhat flattened. The two lobes in hemisyncarpous fruits or the drupelets in the apocarpous fruits differ considerably in their mutual relationship as well as in shape. They may either be parallel or divergent to differing degrees. These characters offer trustworthy taxonomic criteria for specific diagnosis. With the gradual ripening of the fruit there is a change in the color of the pericarp from green to red and black. This is true for almost all the species. The exocarp is usually thin and membranaceous. The

[21] Woodson & Moore, in Bull. Torr. Bot. Club 65:147. 1938.
[22] Boke, N. H., in Am. Jour. Bot. 35:422–423. 1948.

mesocarp is fleshy, rarely slightly fibrous, and the endocarp stony. *R. linearifolia,* the dwarf undershrub of eastern Cuba, has fruits with unusually thin pericarps resembling superficially a follicle more than a drupe. The stone is usually sclerotic, with a smooth or rugose outer surface and a smooth inner surface. It is generally ovoid, with a stout basal region and a rather flattened distal region. The stone also offers some reliable key characters. In all the species there is a tendency towards the abortion of one of the carpels during development. Although a considerable number of extra-American species possess apocarpous fruits, *R. sellowii* is the only American species on which they occur.

Seed: The seed is albuminous and is usually symmetrically ovoid. In *R. nitida* of section MACROVOLFIA and in all the species of section RAUVOLFIA the seed is slightly gibbous. This is true also in several African and Asian species. The seed-coat is membranaceous and easily separable from the endocarp, on the one hand, and the albumen, on the other. The albumen is carnose, entire, and fairly abundant.

The embryo is typically dicotyledonous, either erect or slightly to strikingly arcuate. Usually it is about as long as the seed, with the terete hypocotyl about equal to the usually ovate, obtuse cotyledons.

Seedling: I have observed germination in the seeds of *R. tetraphylla, R. littoralis,* and *R. serpentina.* Owing to the sclerotic endocarp, they require from ten to thirty days for the first signs of germination. The radicle emerges first, and three to four days later the crook of the plumule appears and soon becomes erect and disentangles the cotyledons from the still-persisting endocarp and seed-coat. The cotyledons expand and serve as the first pair of green leaves for the seedling. In *R. tetraphylla* and *R. littoralis* the cotyledonary leaves are ovate and obtuse, but in *R. serpentina* they are orbicular, rounded, or slightly emarginate. Only pairs of decussate leaves are produced in the subsequent two or three nodes of the actively growing seedlings. The fourth node, however, almost invariably exhibits the characteristically whorled phyllotaxy of the adult plant. The plants of *R. tetraphylla* appear to be precocious and flower when they are about four months old.

Anatomy: The literature contains very little reference to the anatomy of *Rauvolfia.* Metcalfe and Chalk[23] have remarked briefly on the anatomy of Apocynaceae. The recent importance of the roots of *Rauvolfia,* from the point of view of the pharmacognosists, has required a precise knowledge of their anatomy for accurate determination of the species and for detection of adulterants.

Woodson[24] has recently reported on the anatomy of about twenty *Rauvolfia* species, of which nine are American. At least in one example there is no verifiable herbarium material available, resulting in a certain amount of doubt. Even as the cytologists are increasingly depositing specimens of plants which they investigated in an herbarium, it is strongly recommended that anatomists and biochemists

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[23] Metcalfe, C. R. & Chalk, L. Anatomy of the Dicotyledons 2:914. 1950. Oxford.

[24] Woodson et al. *Rauwolfia:* Botany, Chemistry and Pharmacology. Little, Brown & Co., Boston. In print.

too realize the advantage of preparing herbarium specimens for resolving future questions of identity.

In a genus characterized by copious latex, surprisingly, no laticiferous tubes have been observed in *Rauvolfia* roots even though artifacts simulating latex tubes have been noticed in the Asian *R. serpentina* and *R. cambodiana.* This is in keeping with the observation of excised roots of living plants.

The roots are tetrarch and in the mature state have metaxylem to the exclusion of the pith. The outer bark is of varying thickness and consists of phloem and phellem. The bark may be flaky or indefinitely ribbed. The color of the bark also varies in relation to the color of the soil in which the roots grow. The secondary phloem is characterized by the presence of sclerotic cells, either in the form of prominent bands or of scattered nests of few to many cells. The xylem consists of vessels, tracheids, and xylem parenchyma. Growth rings are not present in many of the species. The diameter of the vessels varies considerably, offering a reliable guide for species determination.

The phloem and xylem characteristics show a trend—possibly phylogenetic—indicative of a transition from the arboreal to the sub-herbaceous habit. The phloem exhibits a change from strongly radially arranged sieve cells collapsible on desiccation in the arboreal species, to weakly radial, non-collapsible sieve cells in the shrubby species. There is a parallel change in the prominence of the sclerotic nests of the phloem. An associated change has been noticed in the xylem, the tracheary wedges consisting roughly of about 50 per cent of the volume in the arboreal species and 25 per cent or less in the shrubs. The vessels in the arboreal species are wide, as much as 250μ in diameter, while those of the least ligneous shrubs are as narrow as 20μ. To what degree phylogenetic value can be attached to these trends is an open question. Based as the study was on only about 20 species for the world, it is not surprising that Woodson has "failed to associate definite anatomical characteristics with Pichon's fourteen sections".

Variation and Hybridization

The multiplicity of specific names for essentially similar plant populations of *Rauvolfia* has been due to an inadequate awareness of the range of variability. Many of the species, particularly in the New World, show variation in leaf and inflorescence characters which has led astray earlier students of the genus. *R. mollis,* from Mato Grosso, and *R. paraensis* and *R. pentaphylla,* from the Amazon area, offer examples for such variation to a limited degree. *R. macrophylla, R. caffra* of Africa, and *R. verticillata* of Asia, also have caused much taxonomic confusion by their variability.

Two of the American species that have been the cause of vexatious problems of synonymy are *R. tetraphylla* and *R. ligustrina.* Fairly abundant material of these two species has afforded me an opportunity for a statistical analysis of variation in some measureable characters. A perusal of the literature provided me with a list of characters that had attracted the attention of the earlier students. These

characters are: leaf number per whorl, leaf shape and size, degree of anisophylly, degree of clarity of the vein network, leaf indument; peduncle length and degree of branching; flower number per peduncle; corolla-tube length and fruit size. Of these, the characters that I have measured are indicated by their mean values in the following chart (p. 266).

At first I obtained data for small populations restricted to narrow areas. As these data did not reveal any pattern of variation, as a matter of convenience I divided the populations into three major areas: Antilles, Central America, and South America. The variability in leaf shape in *R. tetraphylla* is erratic and cannot be correlated with any other character. The ideograph and the accompanying mean values (fig. 1 of chart) show to what extent the measured characters of these populations are alike. An evident variable character is the pubescence of the leaf. The Central American populations have an overwhelmingly large number of glabrous plants; the Antillean are the most pubescent; while the South American populations are intermediate with puberulent leaves. This is true in spite of the disparity in the sample size from the three areas. However, in each of these regions it is not unusual to encounter plants exhibiting the extreme conditions of pubescence. Because of inconsistency in the variability of these populations, I would not consider according even subspecific rank to them.

The second species analyzed, *R. ligustrina,* indicates a quantitative variation in leaf size in the three areas (fig. 2 of chart). Here again a disparity in the sample size makes the conclusion somewhat uncertain.

In *R. tetraphylla,* I was able to note the trend in variation and to compare my data from herbarium material with data from plants growing in the greenhouse. I have observed one plant each from Costa Rica, Cuba, and the Dominican Republic, and about twenty plants from Lucknow and the Anamalai hills, both introduced in India[25] from the Antilles.

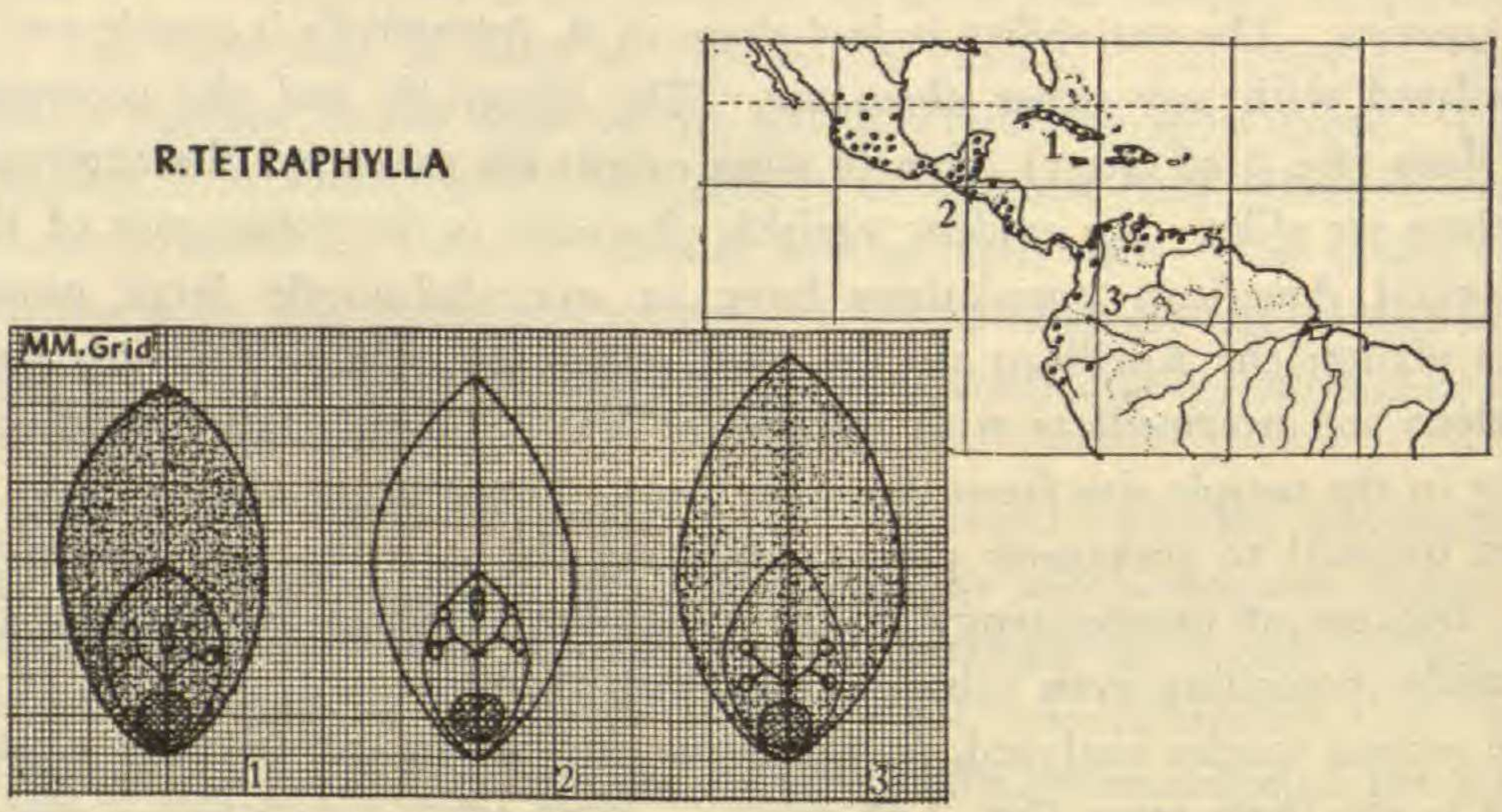
A study based only on herbarium material cannot be expected to provide an explanation for this variability in these two species. However, it may be significant that these two species are widespread and have been well known to man and associated with his environment. As to what extent variability is inherent in these species and to what extent it may be due to extraneous agents can only be resolved by carefully planned cytogenetic experiments. The large-scale cultivation of *R. tetraphylla* plants in some areas, and their spreading as weeds in India, and more recently in Australia, should also afford ideal opportunity for a detailed field study of variation in this species.

Hybridization: Herbarium material is not ideal for providing conclusive data regarding hybridization. However, often specimens which could not be referred with certainty to one of two sympatric species pointed to the possibility of introgression. Several such specimens were encountered, particularly of *R. tetraphylla* populations. *R. tetraphylla* is sympatric, in the range of its distribution, with three closely related species: *R. ligustrina, R. littoralis,* and *R. viridis.* The fre-

[25] Voigt, J. O. Hort. Suburb. Calcut. Cat. Pl. p. 202. 1845.

Region	Sample size	Largest leaf l'gth × b'dth	Smallest leaf l'gth × b'dth	Leaf indument			Length of peduncle	Number of flowers per peduncle	Fruit	
				Glabr.	Puber.	Pubes.			Height	Breadth
		(cm.)	(cm.)				(cm.)		(mm.)	(mm.)
1. Antilles	77	5.9 × 2.6	3.0 × 1.8	9	17	51	1.2	5	6.4	7.2
2. Cent. America	255	6.2 × 2.9	3.0 × 1.8	220	35	0	1.3	5	6.2	7.1
3. So. America	47	6.6 × 2.8	3.4 × 1.4	4	39	4	1.3	5	6.4	7.5

Rauvolfia tetraphylla



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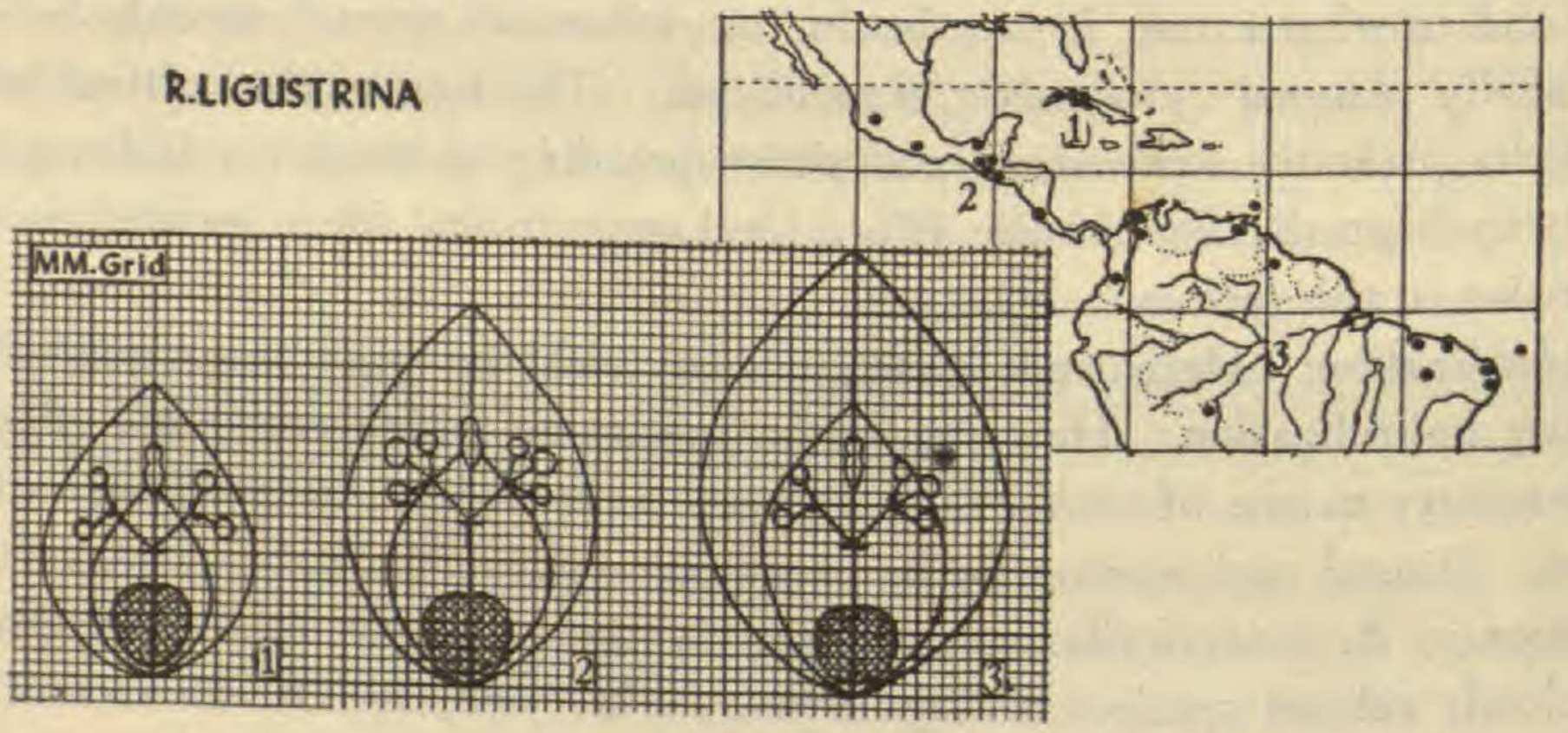
Region	Sample size	Largest leaf l'gth × b'dth	Smallest leaf l'gth × b'dth	Length of peduncle	Number of flowers per peduncle	Length of corolla tube	Fruit	
							Height	Breadth
		(cm.)	(cm.)	(cm.)		(mm.)	(mm.)	(mm.)
1. Cuba	21	2.3 × 1.6	1.5 × 1.1	1.0	5	3.0	5.6	6.5
2. Cent. America	15	3.0 × 2.0	1.8 × 1.3	1.3	7	3.0	5.6	6.7
3. So. America	39	3.5 × 2.4	2.2 × 1.2	1.2	6	3.0	5.5	6.4

Rauvolfia ligustrina



2

Chart showing variation in two species of *Rauvolfia*

quency of fruits with abortive embryos in many of these examples indicates a genetic abnormality and lends further support to the possibility of hybridization.

An instance of what, in my opinion, is very possibly a complex hybrid has been described as a distinct species, *R. mollissima* Mfg. The original description of this species is based on two specimens: *Tonduz 13940* from Costa Rica, and *Karsten 17b* from Colombia. I have examined both specimens. Of the two, the Tonduz specimen inclines more toward *R. littoralis* in leaf shape and size, inflorescence branching, and flower number, though to a large extent, particularly in leaf indument, it resembles the other suspected parent, *R. tetraphylla.* Similarly, the Karsten specimen, while resembling *R. tetraphylla,* still indicates a close approach in those characters to *R. viridis.* I have treated *R. mollissima* as a synonym of *R. tetraphylla.* The situation is obviously complicated by a complex, interbreeding involving several back-crosses. Also, I have strongly suspected hybridization in *R. paraensis* and *R. sprucei.* I am recording these opinions with the hope that they will stimulate further observations in the field.

Economic Uses

The many names existing for several *Rauvolfia* species throughout the world testify to man's familiarity with these plants. I have listed the known common names separately under each species.

The most significant use of *Rauvolfia* plants has been in the healing of certain chronic human ailments. The raw roots of the Asian *Rauvolfia serpentina* have been used for several centuries in treating intestinal disorders and in heart and nervous conditions. Recent biochemical and clinical investigations have amply proved the efficacy of the chemical contents of the roots in alleviating high blood pressure and in calming excitable subjects. The invaluable nature of the chemical contents naturally has led to an extensive investigation of the substances involved, not only in the famed Asian species but also in many of the related ones.

Much information on the botany and chemistry of *Rauvolfia serpentina* is available and I do not propose to duplicate it here. Monachino[26] has a detailed contribution on the botany of the species, while the New York Academy of Sciences[27] has published a symposium on the chemistry, pharmacology, and clinical nature of the active alkaloid, reserpine, the most valuable of about 30 alkaloids so far isolated from the roots of *R. serpentina.* Furthermore, Feuell[28] has a more general account of several important *Rauvolfia* species which is particularly valuable for its exhaustive bibliography.

With the recent pharmacological vindication of the early claims from folk-lore of the curative properties of *serpentina* roots, attention has now been directed to some related species. Several additional species have been found to contain the reserpine in exploitable quantities. Almost all commercially extracted reserpine is

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[26] Monachino, J., in Econ. Bot. 8:349–365. 1954.
[27] Miner, R. W. (editor). Ann. N. Y. Acad. Sci. 59:1–140. 1954.
[28] Feuell, A. J., in Colon. Pl. & An. Prod. 5:1–33. 1955.

now obtained from the African *R. vomitoria* and the circum-Caribbean *R. tetraphylla*. A detailed account by Schittler[29] of the chemistry of the several species so far investigated is expected in a forthcoming publication.

In America *R. tetraphylla* and *R. nitida* have been much used in indigenous medicine. The decoction of the bark and leaves has been used as a gargle and internally administered in intestinal disorders and in syphilitic infections. The bark has been further used as an unguent on skin eruptions. The fruits are reputedly poisonous. In Nicaragua the fruits of *R. tetraphylla* have been used as a source of ink and a black dye.

Standley[30] and Roig y Mesa[31] have recounted these numerous uses for the two species in Central America and in Cuba respectively, while Descourtilz[32] has given a picturesque account of the deleterious properties of *R. nitida*, which he refers to as *R. canescens*. An accurately colored illustration of the plant in the text leaves no doubt regarding the identity of the species. A confusion on this count has led Feuell to attribute all properties of *R. nitida*, described by Descourtilz, to *R. canescens*, which is identical with *R. tetraphylla* of Linnaeus.

Apart from the medicinal importance, some of the arboreal species are useful as sources of timber. Record and Hess,[33] however, do not attach much importance to the value of *Rauvolfia* as a source of timber. They describe the wood as of fine texture, easily worked, but perishable in contact with the ground. Monteiro da Costa mentions the use of *R. pentaphylla* wood for "furniture and turnery work." *R. nitida* has been introduced into Florida and has been recommended as an efficient wind-break on the seashore.

R. salicifolia and *R. cubana* bushes, with their glistening coriaceous leaves and fragrant flowers, invite serious consideration as ornamental plants in tropical and subtropical gardens and parks.

Geography

I will confine myself here to a general discussion of the geography of the genus. Data concerning the ecology and distribution of individual species have been included with the descriptions, while the accompanying maps indicate areas which could be accurately plotted on the outline maps with the help of the 'Lippincott's Gazetter of the World' and an assortment of large-scale maps published by the National Geographic Society and other such agencies.

Rauvolfia is a pantropical genus, with a distribution extending to the 30th parallel in the north as well as the south. In addition to tropical America, there are numerous species in Africa, Asia, and in several of the Oceanic islands. How-

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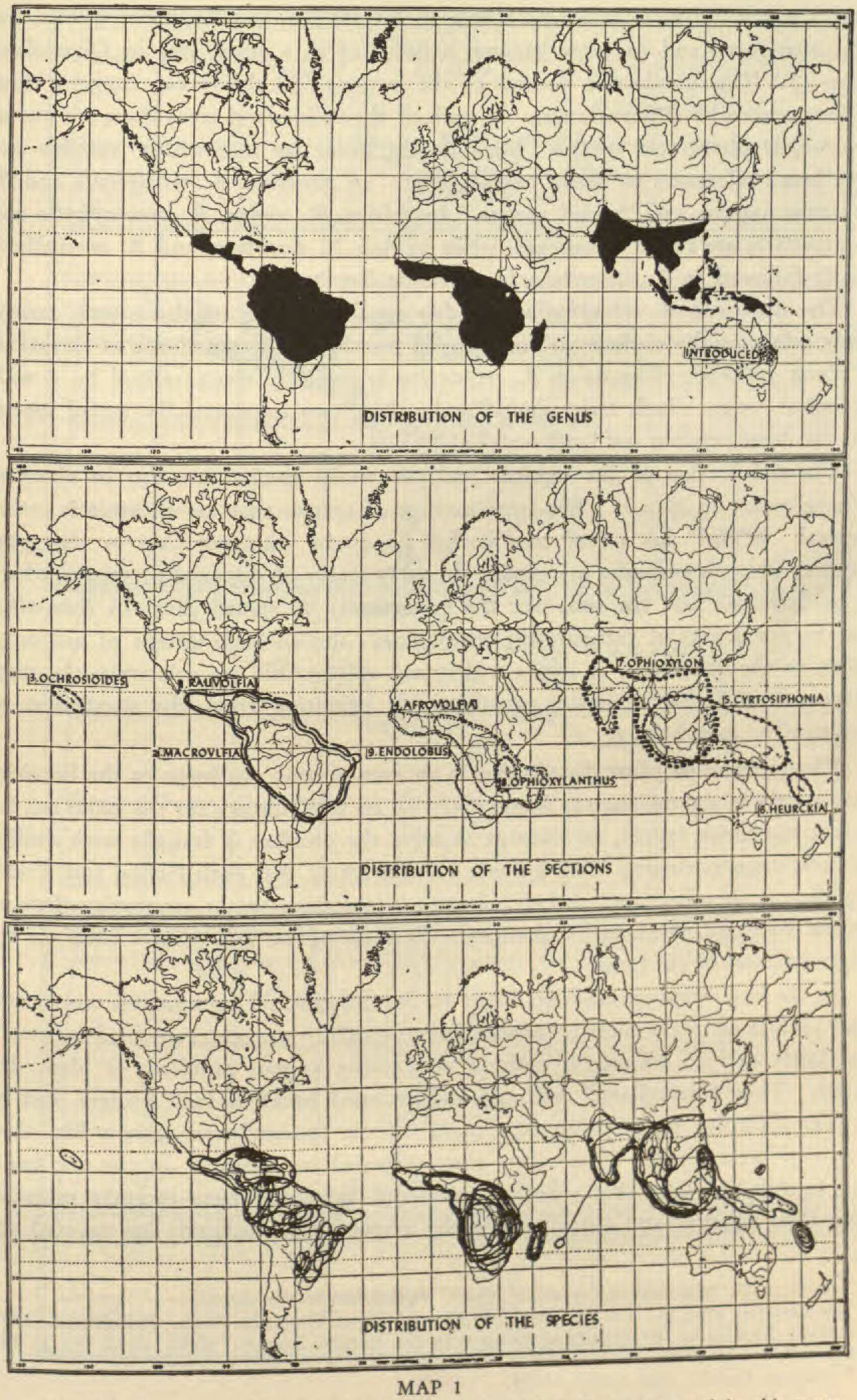
[29] Schittler, H., in Woodson et al., *Rauwolfia:* Botany, Chemistry and Pharmacology. Little, Brown & Co. Boston. In press.
[30] Standley, P. C. Trees and shrubs of Mexico. In Contr. Smithson. Inst. 23:1153. 1924.
[31] Roig y Mesa, J. T. Plant. Medicin. Aromat. Venen. de Cuba. p. 631. 1945. Havana.
[32] Descourtilz, M. E. Fl. Med. Ant. 3:151. 1827.
[33] Record, S. J. & Hess, R. W. Timbers of the World. p. 66. Yale Univ. Press. 1943.



MAP 1

Distribution of *Rauvolfia* throughout the world. (All outline maps used in this paper are from Goode's Series of Base Maps, University of Chicago Press.)

ever, it is not native to Australia where *R. tetraphylla*, the American species, has been introduced and has now become naturalized in a small area in Queensland (Map 1). The distribution pattern of the sections and the species suggests three or four centers of differentiation. In each of the major land areas there are one or two widely distributed species. Significantly, these are also widely variable and have broad tolerances to varied environment. In America, *R. tetraphylla* and *R. ligustrina* are the two "wide" species. In Africa, *R. caffra*, *R. macrophylla* and *R. vomitoria* are fairly widespread, while in Asia *R. densiflora* and *R. verticillata*, closely followed by *R. serpentina*, have a wide distribution.

The American *R. tetraphylla* flourishes equally well in much-exposed, sunny, sandy soils near the seashore and in wet and marshy, shady grasslands at elevations of about 2000 m. The Asian *R. serpentina* is similarly characterized by a wide ecological range. Such traits should make these two commercially useful species easy for domestication and large scale cultivation.

The distribution of the sections and the world species can also be obtained by a reference to Map 1. The large number of species that are endemic is rather unusual. Willis[34] has stated that he has no doubt whatever that in the great majority of cases endemics are simply the early stages of dispersal of species which as yet have not had the time nor the opportunity to spread far. In *Rauvolfia*, however, evidences of comparative morphology, and to some extent of anatomy, points to the contrary. It is the widespread species that are relatively the most advanced, while the endemics are relatively primitive from the standpoint of comparative morphology.

The problem of plant distribution is an ever-present challenge to the botanist. Particularly in a genus such as *Rauvolfia*, with no fossil history for the genus nor for almost the entire family, an attempt to solve the problem is fraught with disillusion and disappointment. It is perhaps for this reason that both Pichon and Woodson, though they have included considerable information on the geography of many genera, have not attempted to integrate the information and present ideas on the origin and area of the family.

In the past, with an innocent belief in the existence of innumerable convenient land bridges or in the drifting apart of the originally concentrated land masses, it was fairly easy to advance hypotheses concerning various problems of plant dispersal. Thus Macfarlane,[35] with an unquestioned belief in land bridges, had no further difficulty in believing that many of the apocynaceous genera had their origin in West Africa, from where they migrated to America, on the one hand, and to Asia, on the other. Both Good[36] and Schmidt[37] have recently reviewed such ideas in plant and animal geography respectively. Schmidt has pointed out

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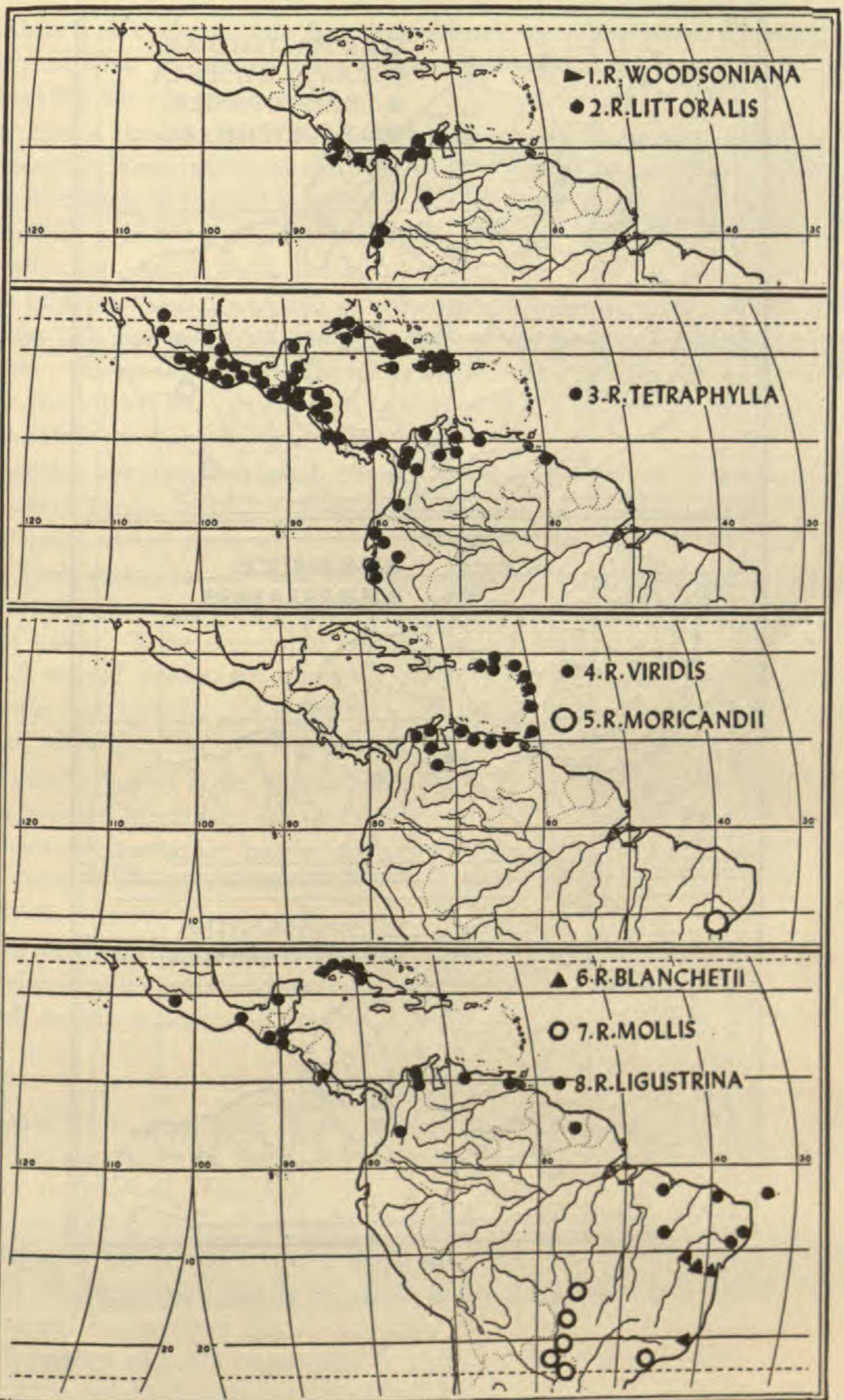
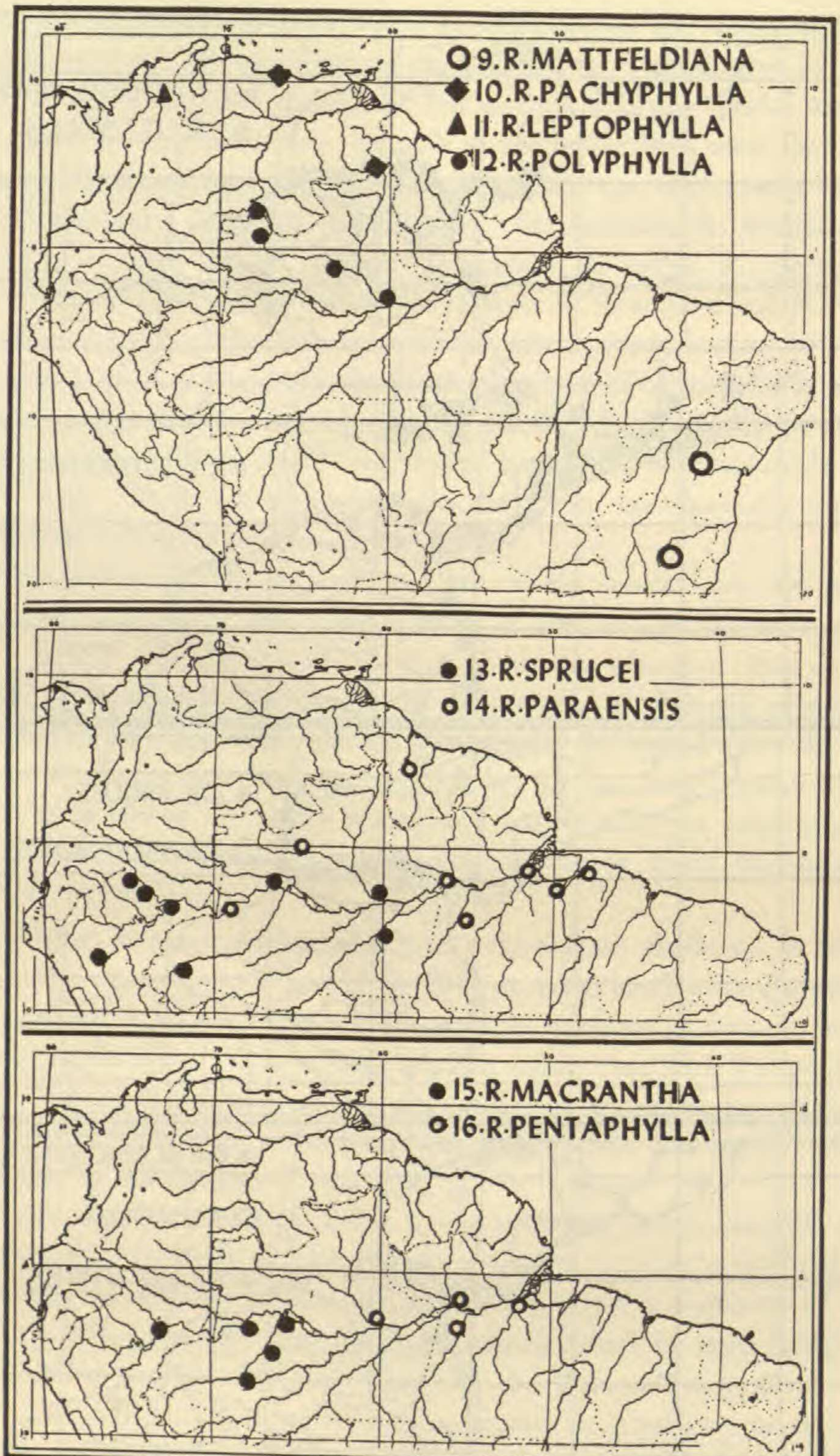
[34] Willis, J. C. The birth and spread of plants. In Boissiera 8:509. 1949.
[35] Macfarlane, John M. The Evolution and Distribution of Flowering Plants. Philadelphia. 1933.
[26] Good, Ronald, in "A Century of Progress in the Natural Sciences." Calif. Acad. Sci. p. 747. 1955.
[37] Schmidt, Karl P. *ibid*. p. 767. 1955.



MAP 2

Distribution of eight species of the section RAUVOLFIA



MAP 3

Distribution of eight species of series LATIFOLIA of the section MACROVOLFIA

that there is no evidence from geology to support the past existence of land bridges other than what are present today, and he gives evidence from geodesic studies to disprove the idea of continental drift.

It cannot therefore be either through land bridges or drifting continents that the spread of *Rauvolfia* from the place of its birth can be explained. Plant dispersal commonly is effected by animals and birds. Here again there is very little information available concerning *Rauvolfia*. Biswas[38] has noted that fruits of *R. serpentina* are eaten by birds and scattered by them. The brightly colored fruits of the other species may similarly be attractive to birds. Many species, not only in America but also in Africa and Asia, have a distribution following rivers and streams. The stones of *Rauvolfia* are hard and can withstand considerable buffeting in water currents. It may well be that birds and water currents together are responsible for the wide dispersal of the genus.

Another tempting problem is that of the center of origin of the genus. Cain[39] has recently made a critical evaluation of the several critera, first used by Adams,[40] as indicators of the center of origin of a genus or species. In the absence of evidence from several sources such as Paleontology, Cytology and Zoogeography, the only recourse is to appeal to the present distribution and comparative morphology of the species. Some supporting evidence may be obtained from the distribution data of related genera, for example, *Aspidosperma*, *Plumeria*, *Tabernaemontana*, *Thevetia*, and *Vallesia*. Of these, only *Tabernaemontana* has a pantropical distribution, while the others are almost exclusively New World genera.

I have estimated about 80 species of *Rauvolfia* for the world, with 34 species in the western hemisphere and the remaining 46 species distributed fairly equally in Africa and Asia in the eastern hemisphere. Species concentration and the maximum number of endemics are evident in tropical America. The eight species of section RAUVOLFIA are the most advanced while the species constituting section MACROVOLFIA include an assemblage variously primitive and advanced. Thus species concentration, species differentiation, and distribution pattern of related genera all indicate the possibility of tropical America being the birthplace of the genus.

RELATIONSHIPS

Rauvolfia is generically distinct, with its whorled leaves, terminal cymose inflorescences, relatively small flowers with eglandular calyx and esquamellate corolla, and the ovary with one or two ovules developing into one-seeded variously connate or free drupelets. However, within the genus, the frequent morphological parallelism in the several species of the major land areas makes a clear-cut classification of the sections slightly difficult. A comparison of the flowers of *R. serpentina* and *R. vomitoria* (figs. C and D), with those of *R. grandiflora* (fig. 23) and *R. praecox* (fig. 32) respectively will best exemplify this situation.

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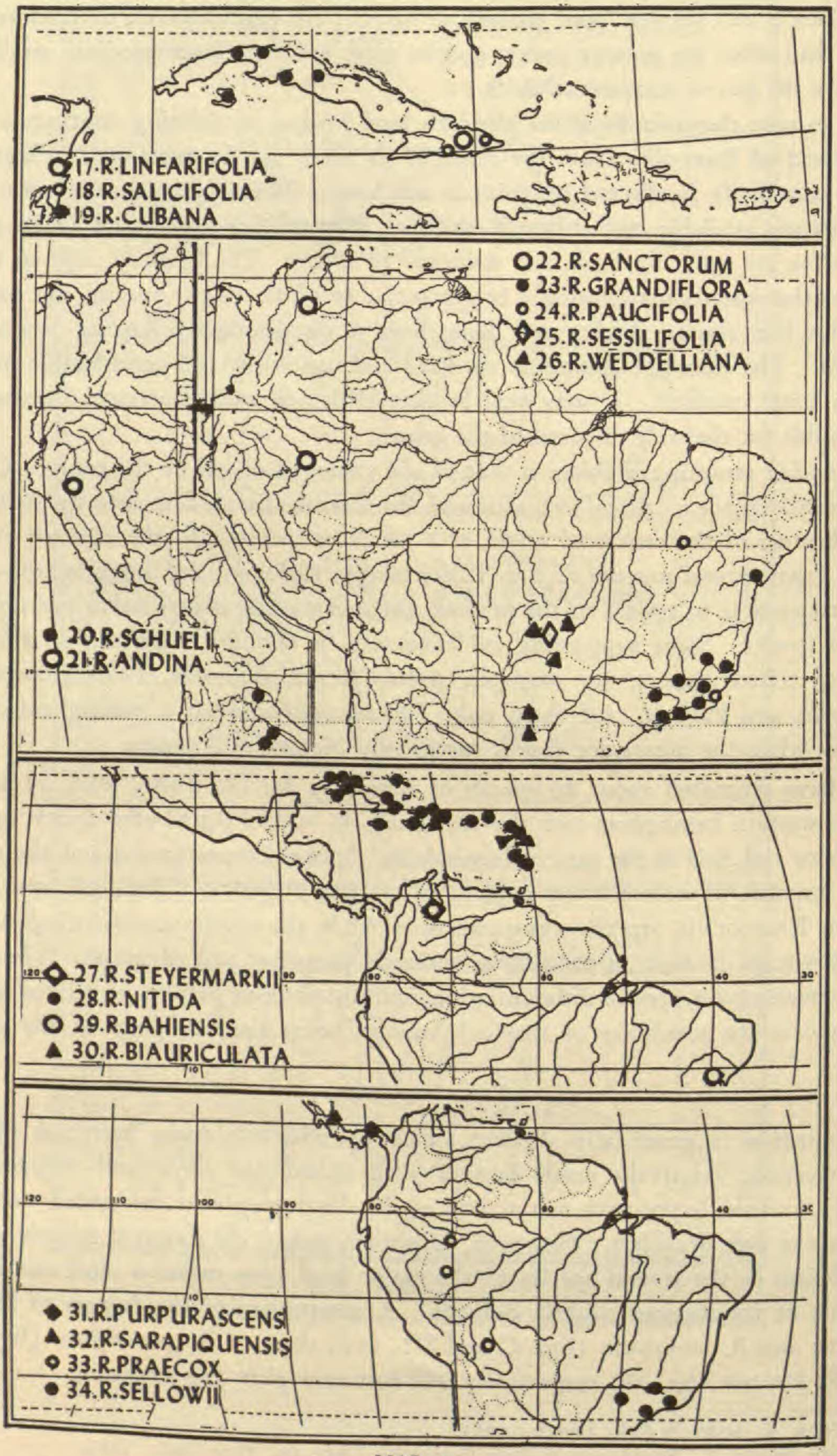
[38] Biswas, K., in Sci. & Cult. 18:579. 1953.
[39] Cain, Stanley A. Foundations of Plant Geography. Chap. 14. New York. 1944.
[40] Adams, Charles G., in Biol. Bull. 3:115–131. 1902.



MAP 4
Distribution of eighteen species of series ANGUSTIFOLIAE of section MACROVOLFIA

Comparative morphology, combined with the geography of the species, serves to produce a reasonably satisfactory key reflecting the natural relationships amongst the species. Some of the characters that provide necessary taxonomic criteria are: shape and size of the corolla and the extent of pubescence within, the position and proportion of the anthers in the corolla tube, the dorsal surface of the anthers, and the extent of carpellary cohesion in the ovary and in the fruit. None of these characters solely can be used in delimiting a section.

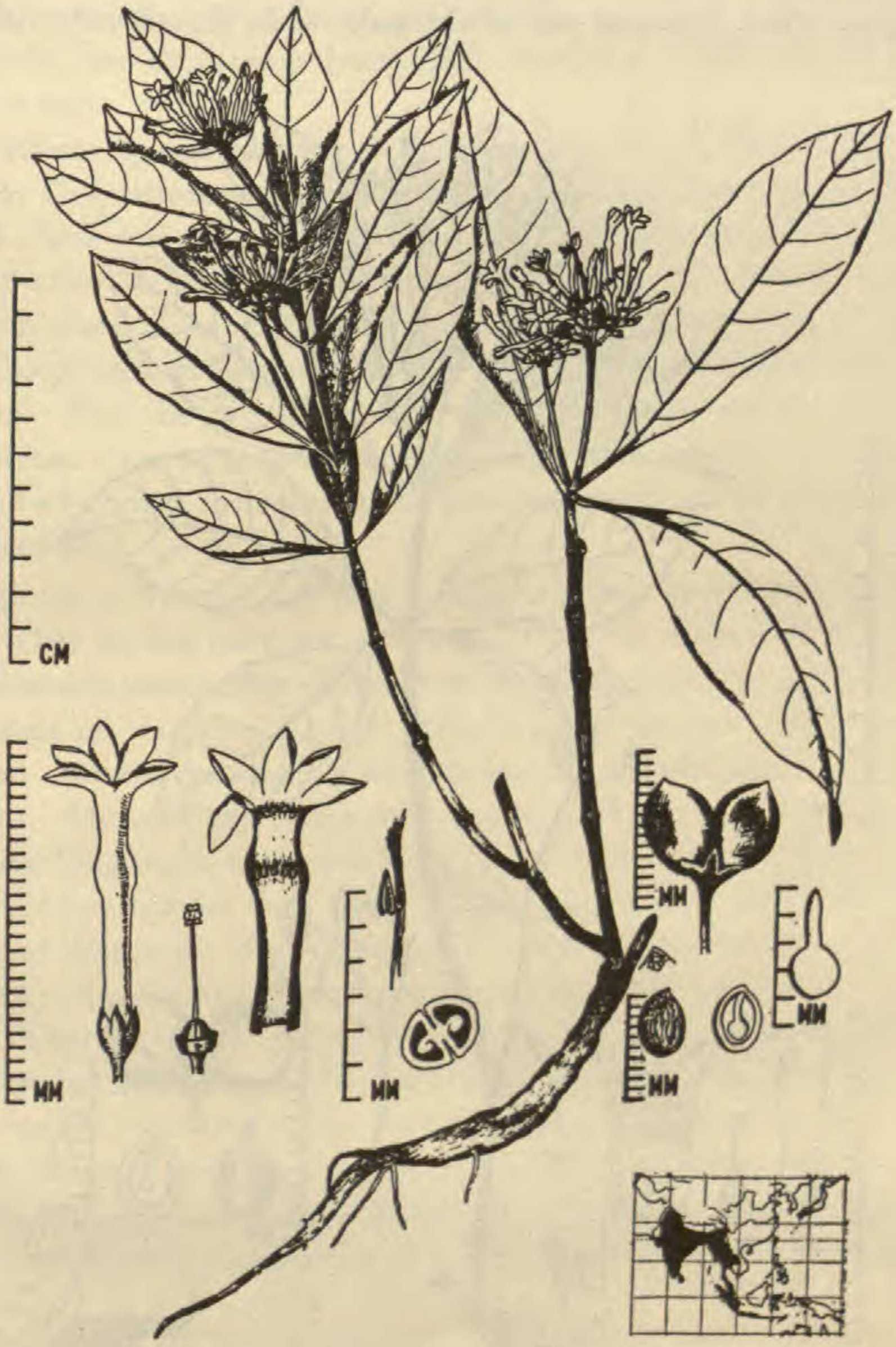


Fig. C. *Rauvolfia serpentina* Benth.

A survey of the above-mentioned and other features in all the species lead to the conclusion that advance in the genus has taken a path of simplification by reduction. Section MACROVOLFIA, with 26 species, exhibits these various characters at different stages of development. Species of series LATIFOLIAE, most of them confined to the Amazon valley, are prominent by their comparatively broad, terminally clustered leaves and fairly large flowers. The fruit, however, is very variable. It is large and fully fused in *R. paraensis* and *R. pentaphylla,* while it is half-fused in the closely related *R. sprucei* and *R. macrantha.* In series ANGUSTIFOLIAE again, *R. grandiflora,* with its large flowers and deeply inserted anthers and hemisyncarpous fruits, is at one end of the scale, while *R. sellowii,* with its short

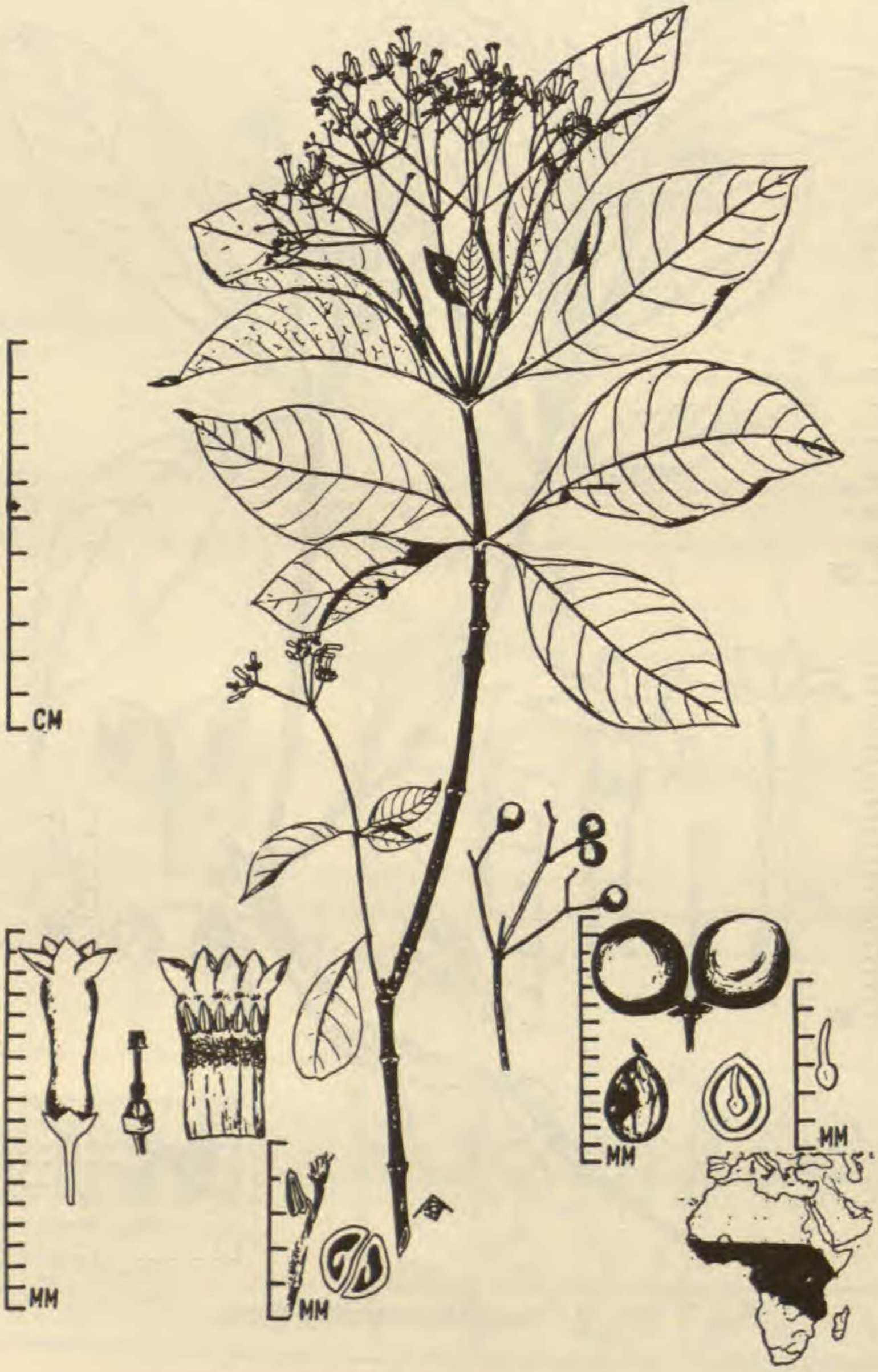


Fig. D. *Rauvolfia vomitoria* Afzel.

flowers and free drupelets, occupies the other end. All the other species can be appropriately placed between these two extremes. *R. nitida*, with its short flowers and syncarpous fruits and slightly arcuate embryos, represents a further step in the evolutionary progress of the genus. In all the other species of section MACROVOLFIA and in most of the species of the other sections, except CYRTOSIPHONIA, the embryo is straight. In several species in each of the sections this tendency for a curved embryo is noticeable. What advantage this imparts to the species is a matter of speculation.

Section RAUVOLFIA, containing mostly undershrubs with variously pubescent or glabrous, membranaceous leaves, tiny flowers in comparatively poorly branched inflorescences, and syncarpous fruits with convolute embryos, represents the most advanced group.

The African species forming section AFROVOLFIA, the Malaysian species forming section CYRTOSIPHONIA, and the Hawaiian species forming section OCHROSIOIDES, all show morphological features extraordinarily similar to the species of section MACROVOLFIA. Likewise, species of section ENDOLOBUS of Africa and Madagascar show close relationship with AFROVOLFIA as well as with MACROVOLFIA, except that in species of section ENDOLOBUS the corolla-lobes are inflexed in the bud. Also the two African species, *R. oreogiton* and *R. volkensii*, constituting section OPHIOXYLANTHUS, with large flowers and the anthers inserted almost halfway down the tube, are in proximity with species of the Asian section OPHIOXYLON.

The species of Hawaii and New Caledonia appear to be evolving in their own fashion. They are less related to the species from the major land masses. Sherff,[41] in a provisional classification of the Hawaiian Rauvolfias, recognized seven species, mainly based on variation in leaf characters but to some extent on calyx and corolla size. Obviously, some factor is influencing a reduction in the size of calyx and corolla. My own experience with the other *Rauvolfia* species makes me cautious in attaching much taxonomic value to leaf characters in founding new species.

The Hawaiian species show some relationship with the species of section MACROVOLFIA of America. They appear to be intermediate between species of series LATIFOLIAE and series ANGUSTIFOLIAE, having generally broad leaves with a strong tendency to persist only at the terminal nodes, fairly large flowers with characteristic foliaceous calyx-lobes, and a rather large corolla. Unlike MACROVOLFIA, the Hawaiian species, constituting the section OCHROSIOIDES, have anthers with smooth backs. In this they resemble the African species of section AFROVOLFIA.

The New Caledonian species, constituting the section HEURCKIA, are distinct. They have strikingly coriaceous leaves 4–6 in a whorl, and the flower with leathery calyx-lobes and twisted corolla. The stigma-head has no distinct collar, but the two apiculate lobes are very prominent. The fruit is apocarpous in all the species and the drupelets are strongly divergent.

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[41] Sherff, Earl E., in Field Mus. Nat. Hist. Bot. 23:321–331. 1947.

My proposed classification of the sections is based on that of Pichon.[42] As I have indicated above, no one character can be given undue weight in delimiting the sections. In my opinion, Pichon's classification suffers from this defect. He has given much importance individually to the extent of fusion of the fruits, the size of the leaves, and the size of the disc around the ovary.

As I have shown above, even in very closely related species the fruit may remain in different degrees of fusion. For example, of the three Cuban species, *R. linearifolia* shows fruits fused only at the base and the lobes divergent, while *R. cubana* and *R. salicifolia* have fruits more than two thirds fused and lobes parallel. Furthermore, all three species have narrow leaves, but they have very close relationships with the rest of the American species.

Referring to the Asian Rauvolfias, Pichon[43] himself has stated that his section OPHIOXYLON differs from DISSOLAENA only in having slightly fused fruits. Consequently, I have merged DISSOLAENA with OPHIOXYLON. On the same basis, I have merged RHOPALANTHUS with ENDOLOBUS and DILOBOCARPUS with CYRTOSIPHONIA, and amongst the American sections HESPEROVOLFIA and MACROVOLFIA. Another section which disappears is CRYPTOGYNE, characterized by species with broad discs concealing the ovary. Except for this, the two species of this section, *R. amsoniaefolia* and *R. chaudocensis*, have many characters in common with the species of section CYRTOSIPHONIA. Hence, I have included CRYPTOGYNE with CYRTOSIPHONIA. While I have examined representative specimens for most of the species, I have not been able to study any specimens for species of section OPHIOXYLANTHUS, nor at least three of the species included in section OPHIOXYLON. I would therefore not claim any finality for this proposed classification of the sections. A further examination of the material for the species I have mentioned may very likely lead to a recasting of the system.

ACKNOWLEDGEMENTS

I am grateful to the people and the government of the United States of America for the award of a Fulbright Fellowship during 1953-54, which enabled me to visit this country and to spend a year of graduate study at Cornell University, Ithaca, New York. I am greatly indebted to Dr. Robert E. Woodson, Jr., of the Missouri Botanical Garden, for much understanding kindness and generosity and considerable guidance in the course of this investigation. My thanks are due to the Ciba Pharmaceutical Products Inc., for the grant of a fellowship during the tenure of which this work was completed. It is also a pleasure to acknowledge the various privileges and facilities accorded to me by Dr. Edgar Anderson, the director, and other authorities of the Missouri Botanical Garden where this research has been carried out. My fellow students have rendered me much help by testing and discussing the taxonomic keys. I should like to express my thanks to the curators of the various herbaria who have lent specimens for my study, and to

[42] Pichon, M., in Bull. Soc. Bot. Fr. 94:31–39. 1947.
[43] Pichon, in Mem. Mus. Nat. d'Hist. Nat. 27:235. 1948.

Dr. K. N. Kaul, director of the National Botanic Garden, Lucknow, India, and Dr. Jorge León of Instituto Interamericano de Ciencias Agrícolas, Turrialba, Costa Rica, for seeds of *R. tetraphylla* from those areas. Finally, I appreciate very much the editorial assistance of Miss Nell Horner in the preparation of the manuscript.

Materials

This study is based on herbarium specimens from the following herbaria. The abbreviations for them are taken from Lanjouw & Stafleu's 'Index Herbariorum' part I (Regnum Vegetabile, vol. 2, 2nd. ed., 1954).

A —Arnold Arboretum, Harvard University, Cambridge, Massachusetts.
EAP —Escuela Agricola Panamericana, Tegucigalpa, Honduras
F —Chicago Natural History Museum, Chicago, Illinois
G —Conservatoire et Jardin Botanique, Genève, Switzerland.
GH —Gray Herbarium of Harvard University, Cambridge, Massachusetts.
K —Herbarium, Royal Botanic Gardens, Kew, England.
L —Rijksherbarium, Leiden, Netherlands.
M —Botanishe Staatssammlung, München, Germany.
MO —Missouri Botanical Garden, St. Louis, Missouri.
NY —New York Botanical Garden, New York, New York.
P —Muséum National d'Histoire Naturelle, Laboratorie de Phanérogamie, Paris, France.
RB —Jardim Botanico Rio de Janeiro, Rio de Janeiro, Brazil.
S —Naturhistoriska Riksmuseum, Botanical Department, Stockholm, Sweden.
UC —Herbarium of the University of California, Berkeley, California.
UPS —Institute of Systematic Botany, Botanical Garden and Botanical Museum of the University of Uppsala, Uppsala, Sweden.
US —National Museum, Smithsonian Institution, Washington, D. C.
W —Naturhistorisches Museum, Wien, Austria.

Taxonomy

RAUVOLFIA [Plum.] L. Sp. Pl. ed. 1. 208. 1753; Gen. Pl. ed. 5. 98. 1754; Pichon, in Bull. Soc. Bot. Fr. 94:32. 1947. L. Gen. Pl. ed. 7 (Reichard). 118. 1778 (as RAVWOLFIA). L. Gen. Pl. ed. 8 (Schreber). 160. 1789; L. Sp. Pl. ed. 4 (Willdenow). 1217. 1798; A. DC. in DC. Prod. 8:336. 1844; Benth. & Hook. Gen. Pl. 2:637. 1876; K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4^2:153. 1895 (as RAUWOLFIA).

Ophioxylon L. Sp. Pl. ed. 1. 1043. 1753.
Dissolaena Lour. Fl. Cochinch. 137. 1790.
Cyrtosiphonia Miq. Fl. Ind. Bat. 2:401. 1856.
Heurckia Muell.-Arg. in Flora 53:168. 1870.

Lactescent shrubs or trees with dichotomous or verticillate branches, the nodes with small interpetiolar deciduous stipules and persistent glands confined to the leaf-axils or ascending the petiole. LEAVES whorled, 3–5 at each node (opposite in seedlings), petiolate or sessile, simple, entire, penninerved, membranaceous or coriaceous, glabrous or pubescent, often anisophyllous. INFLORESCENCES terminal or lateral and interpetiolar, often geminate, 2-, 3- or 4-chotomously branched, bracteate, few- to many-flowered dichasia. FLOWERS pedicellate or sessile; calyx cam-

panulate, 5-lobed, the lobes eglandular within; corolla salverform, infundibuliform, urceolate or campanulate, usually white, glabrous externally and variously villous internally, the lobes 5, equal, sinistrorsely contorted, the apices usually just overlapping in the bud, rarely inflexed; stamens 5, epipetalous, the anthers free from each other and the stigma, included, fully fertile, the filament slender, short, the pollen-grain spherical or subspherical, triculpate; pistil 2-carpellary, superior, the ovary apocarpous or variously syncarpous and bilocular, with 1–2 ovules on a ventral or axile placenta, the disc annular or cupuliform, entire or dentate, the style single, slender, usually glabrous, rarely villous at the base, the clavuncle or the stigma-head conspicuous, cylindrical, calyptriform or sub-mitriform, obscurely bi-apiculate. FRUITS apocarpous or variously syncarpous drupes, often only one carpel developing, 1-seeded, the seeds stout or flat, with a membranaceous testa and a linear hilum, albuminous, the albumen carnose, entire, easily separable from the testa, the embryos nearly as long as the seeds, or half as long, straight or slightly to deeply arcuate, the cotyledons 2, flat, fleshy, ovate, obtuse, the hypocotyl terete, about as long as the cotyledons.

TYPE SPECIES: *Rauvolfia tetraphylla* L.

KEY TO THE SECTIONS

A. Leaves with glands in the axil and on the petiole. Corolla-tube urceolate. Fruits fully syncarpous, globose; embryo U-shaped. Antilles, Central America, and South America. .....Sect. I. RAUVOLFIA

AA. Leaves with glands in the axil only. Corolla-tube salverform, infundibuliform, or campanulate. Fruits apocarpous or variously syncarpous, globose or bilobed; embryo straight or slightly curved.

B. Corolla-lobes not inflexed in the bud.

C. Throat of the corolla-tube very narrowly pilose within (a ring of less than 1 mm.), above the anther-tips.

D. Anthers clearly dorsifixed. Stigma-head with distinct collar. Fruits apocarpous or variously syncarpous, the drupelets slightly divergent.

E. Anthers with a callosity at the back; filaments short and indistinct. Antilles, Central America, and South America.....Sect. II. MACROVOLFIA

EE. Anthers with a smooth back; filaments slender and distinct.

F. Anthers 6 to 8 times shorter than the corolla-tube.

G. Corolla-tube 7–12 mm. long. Hawaii.....Sect. III. OCHROSIOIDES

GG. Corolla-tube 2–6 mm. long. Tropical Africa and Madagascar. .....Sect. IV. AFROVOLFIA

FF. Anthers 2 to 4 times shorter than the corolla-tube. Southeast Asia and Malaysia.....Sect. V. CYRTOSIPHONIA

DD. Anthers seemingly basifixed. Stigma-head with indistinct collar or none. Fruits apocarpous, the drupelets divaricate. New Caledonia.....Sect. VI. HEURCKIA

CC. Throat of the corolla-tube pilose in a fairly broad band within (from 2 to 6 mm.), above the anther-tips.

H. Ovary apocarpous or syncarpous only at the base. Fruits apocarpous or syncarpous only at the base, the drupelets divergent. Southeast Asia and Malaysia.....Sect. VII. OPHIOXYLON

HH. Ovary syncarpous almost to its middle. Fruits syncarpous almost to the tip, the drupelets parallel. East Africa.....Sect. VIII. OPHIOXYLANTHUS

BB. Corolla-lobes deeply inflexed in the bud. Tropical Africa and Madagascar. .....Sect. IX. ENDOLOBUS

RAUVOLFIA IN AMERICA: KEY TO SECTIONS AND SERIES

A. Leaves with intrapetiolar glands in the axil and on the petiole, membranaceous, glabrous or pubescent. Flowers small, corolla-tube 2–3 mm. long (4–5 mm. in *R. moricandii*). Fruits fully syncarpous, 5–8 mm. wide (rarely 18 mm. in *R. littoralis*), globose. Embryo U-shaped.....Sect. I. RAUVOLFIA
  B. Leaves 4 at each node, rarely 3 or 5, the largest leaf at each node 5–16 cm. long. Inflorescences 2–4 times shorter than the associated large leaf.....Ser. 1. TETRAPHYLLAE
  BB. Leaves 3 at each node, rarely 4, the largest leaf at each node 3–5 cm. long. Inflorescences about as long as the associated large leaf.....Ser. 2. TERNIFOLIAE
AA. Leaves with intrapetiolar glands confined to the axil, membranaceous or coriaceous, glabrous. Flowers large, corolla-tube 4–24 mm. long. Fruits apocarpous or variously syncarpous, 9–30 mm. wide, bilobed (globose in *R. paraensis* and *R. pentaphylla*). Embryo straight.....Sect. II. MACROVOLFIA
  C. Flowering twigs leafy only at the tips; bud-scales or their scars present immediately above each node, the current growth consisting of but one verticillate node. Leaves about twice as long as broad (up to 3 times in *R. polyphylla*), obtuse to rounded at the base. Inflorescences terminal.....Ser. 3 LATIFOLIAE
  CC. Flowering twigs leafy throughout; bud-scales or their scars usually absent above the nodes, the current growth consisting of several verticillate nodes. Leaves 3–4 times as long as broad (about twice as long in *R. steyermarkii*), gradually attenuate at both ends or at least at the base. Inflorescence terminal or lateral.
.....Ser. 4. ANGUSTIFOLIAE

SECTION I. RAUVOLFIA

§ *ANISOPHYLLAE* Mgf., in Fedde, Rep. Spec. Nov. 20:113. 1924.
§ *AMEROVOLFIA* Pichon, in Bull. Soc. Bot. Fr. 94:32, 38. 1947.

SERIES 1. TETRAPHYLLAE A. S. Rao, ser. nov.

Folia quaternata rarius ternata vel quinata in quoque nodo, folio majore 5–16 mm. longo. Inflorescentiae folio majore 2- vel 4-plo breviores. Species typica: *R. tetraphylla* L.

KEY TO THE SPECIES

A. Leaves strikingly anisophyllous, the smallest leaf of each node about half as long as the largest. Inflorescences mostly lateral. Calyx-lobes acute, obtuse, or rounded.
  B. Largest leaves at the node narrow, 3 to 4 times as long as broad, lanceolate, glabrous, distinctly petiolate. Inflorescences lax, with elongate peduncles. Costa Rica.
.....1. *R. woodsoniana*
  BB. Largest leaves at the node broad, about twice as long as broad, ovate, ovate-elliptic, or obovate, glabrous or pubescent, indistinctly petiolate. Inflorescences condensed, with short peduncles. Calyx-lobes acute, obtuse, or rounded.
    C. Leaves obovate, acuminate, gradually tapering at the base, glabrous or minutely puberulent. Inflorescences much-branched, 16- to many-flowered. Calyx-lobes obtuse or rounded. Costa Rica to Colombia, Ecuador, and Venezuela.
.....2. *R. littoralis*
    CC. Leaves ovate or ovate-elliptic, acute or obtuse, abruptly tapering at the base, glabrous or pubescent. Inflorescences unbranched, or rarely 1- or 2-branched, 3- to 15-flowered. Calyx-lobes acute. Mexico to Colombia, Ecuador, Peru and Venezuela; Greater Antilles.....3. *R. tetraphylla*
AA. Leaves slightly anisophyllous, the smallest leaf of each node usually more than half as long as the largest leaf. Inflorescences mostly terminal. Calyx-lobes acuminate or cuspidate.
  C. Leaves ovate or ovate-elliptic, 2–3 times as long as broad, secondary veins arcuate. Corolla-tube 2–3 mm. long. Colombia, Venezuela, and Lesser Antilles.....4. *R. viridis*
  CC. Leaves narrowly elliptic, 4–5 times as long as broad, secondary veins transverse. Corolla-tube 3–5 mm. long. Northeastern Brazil.....5. *R. moricandii*

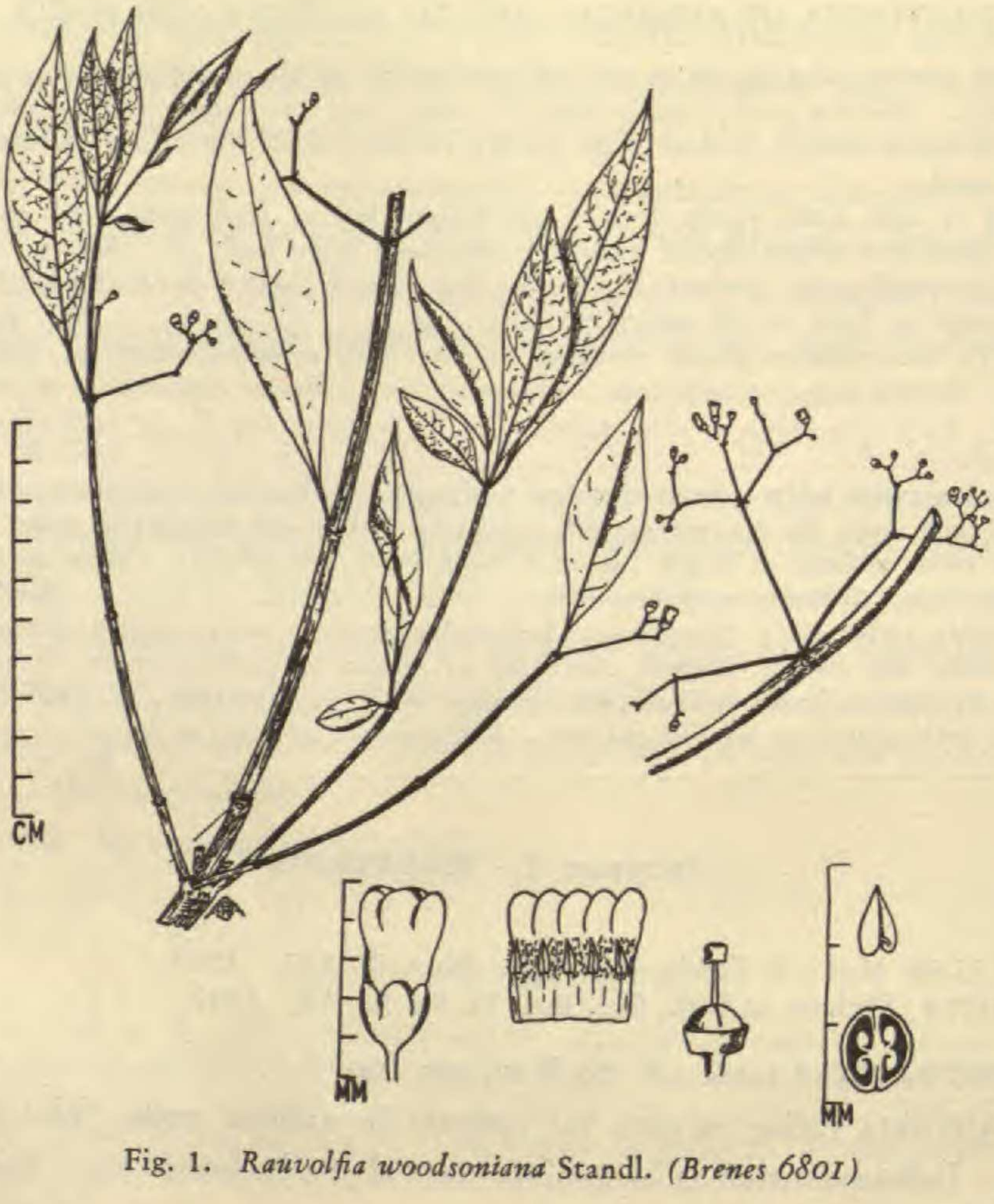

Fig. 1. *Rauvolfia woodsoniana* Standl. *(Brenes 6801)*

1. RAUVOLFIA WOODSONIANA Standl. in Field Mus. Nat. Hist.—Bot. 18:942. 1938. (T.: *A. M. Brenes 6801*!)

Plants with 2-, 3-, or 4-chotomous branches. Twigs slender, faintly angular, glabrous, the nodes with pectinate glands in the leaf-axils and the base of petioles. LEAVES strikingly anisophyllous, in whorls of 4 or sometimes 3 at each node, shortly petiolate, the larger leaves lanceolate, gradually tapering at both ends, 7–12 cm. long, 2–3 cm. broad, the smaller leaves narrowly ovate-elliptic to lanceolate, 1.5–4.0 cm. long, 1.0–1.5 cm. broad, membranaceous, glabrous, the secondary veins delicate, indistinct on the upper surface, but distinct on the under surface, 7–10 pairs, arcuate; petioles distinct, 4–8 mm. long. INFLORESCENCES lateral, interpetiolar, 1, or 2–3 at the nodes, several-flowered; peduncles relatively slender, 2–4 cm. long, 2-, 3-, or 4-chotomously branched, the branches divergent, minutely bracteate; pedicels slender, 2–3 mm. long. FLOWERS small; calyx deeply 5-lobed, the lobes ovate, rounded, minutely ciliolate, about 1.5 mm. long, glabrous; corolla broadly urceolate, the tube 2–3 mm. long, about 1.5 mm. in diameter at the base, glabrous without, but pilose within near the throat and around the stamens, the lobes rotund, about 1.5 mm. long; stamens 5, inserted near the throat, the anthers ovate, acute, about 1 mm. long, the filament distinct, about 0.5 mm. long; ovary

bi-carpellary, syncarpous, subspherical, about 1.5 mm. high, about 1.5 mm. in diameter, glabrous, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style slender, about 1.5 mm. long, glabrous, the stigma-head subcapitate, about 0.5 mm. high, faintly biapiculate. FRUITS not seen.

Flowering in April. La Calera de San Ramon, Costa Rica.

This species is easily separated from its related species by its lanceolate leaves and the loose inflorescences with slender, elongated peduncles.

COSTA RICA. ALAJUELA: San Ramon, *Brenes 6801* (EAP, F).

2. RAUVOLFIA LITTORALIS Rusby, Descr. New Sp. S. Am. Pl. 84. 1920. (T.: *H. H. Smith 1905*!)

R. multiflora Riley, in Kew Bull. 1927:124. 1927. (T.: *L.A.M. Riley 125*!)
R. macrocarpa Standl. in Trop. Woods 16:11. 1928, *nomen;* in Publ. Field Mus.—Bot. 4:254. 1929. (T.: *Cooper & Slater 200*!)

Shrubs and trees with milky latex, up to 9 m. tall. Branches dichotomous, terete, glabrous, sparingly lenticellate, the nodes with slender, interpetiolar deciduous stipules and glands in the leaf axils and on petioles. LEAVES whorled, strikingly anisophyllous, 4 or rarely 5 at the nodes, shortly petiolate, usually obovate, rarely ovate-elliptic or broadly elliptic, acute to acuminate, gradually tapering at the base, rarely abruptly so, the largest leaves 6–16 cm. long, 3–6 cm. broad, the smallest leaves 1–4 cm. long, 0.5–2.0 cm. broad, membranaceous, glabrous or rarely minutely puberulent, the secondary veins distinct on both surfaces, arcuate, 10–12 pairs; petioles 2–8 mm. long. INFLORESCENCES terminal or lateral, interpetiolar, paired at the nodes, several- to many-flowered; peduncles relatively stout, 1.5–4.0 cm. long, 2-, 3- or 4-chotomously branched, minutely bracteate; pedicels slender, 2–4 mm. long. FLOWERS small; calyx deeply 5-lobed, the lobes ovate, obtuse or rounded, about 1 mm. long, glabrous; corolla broadly urceolate or almost campanulate, white, the tube stout, 2–3 mm. long, 1.5–2.0 mm. in diameter at the base, glabrous without, villous within almost to the base, throat densely pilose, the lobes orbicular, 1.0–1.5 mm. long, glabrous or rarely ciliate at the margin; stamens 5, inserted near the throat, the anthers ovate, acute, about 1 mm. long, the filament distinct, about 0.5 mm. long; ovary bicarpellary, syncarpous, subspherical, about 1.5 mm. high, 2.0 mm. in diameter, glabrous, the ovule 1 in each locule on an axile placenta, the disc annular, about 0.5 mm. high, the style columnar, about 2 mm. long, glabrous, the stigma-head depressed-capitate, about 0.5 mm. high, faintly biapiculate. FRUITS spherical or subspherical, 8–15 mm. in diameter, green at first but changing as they ripen from pale red to deep red and black, 2-seeded, the stones ovate, stout and prominently ridged at the base, flattened and smooth above; seeds ovate, albuminous, with a membranaceous testa, the albumen copious, carnose, the embryo strongly arcuate, the cotyledons ovate, obtuse, 2–3 mm. long, the hypocotyl terete, about equal to the cotyledons in length.

Chiefly near sea-shore from 10 to 100 m. altitude. In thickets and somewhat

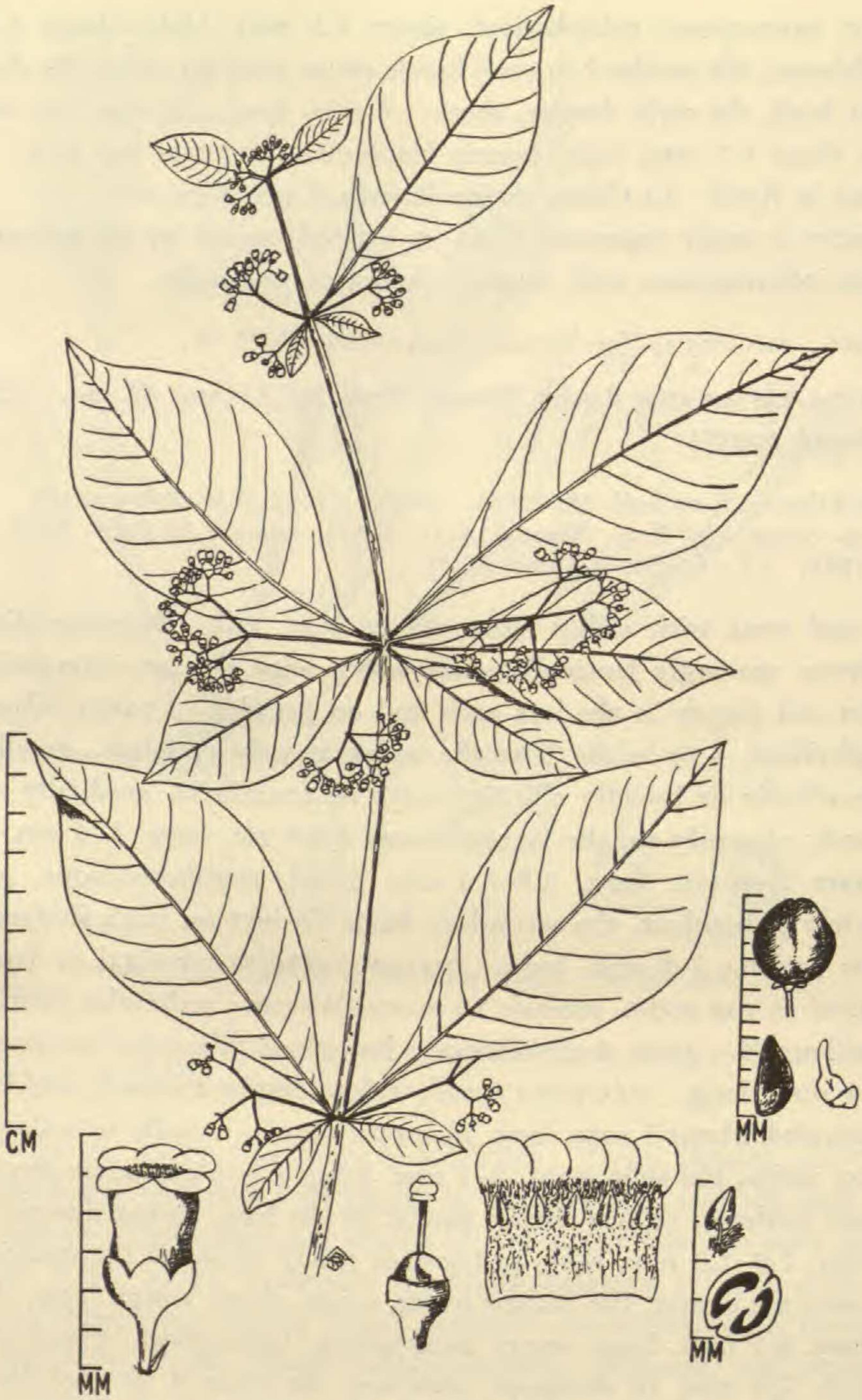

Fig. 2. *R. littoralis* Rusby *(H. H. Smith 1905)*

swampy areas. Flowering and fruiting from June to September. Costa Rica to Colombia, Ecuador and Venezuela.

COMMON NAMES: Colombia—*Anguito, Contra Solita,* and *Cruceto.* Panama—*Fruta del Diablo.*

This species is obviously closely related to *R. tetraphylla* L. It can easily be distinguished by the usually glabrous, obovate leaves with acuminate apex and the very distinct, strongly arcuate secondary veins, and by the usually geminate, many-flowered inflorescences.

Riley, in describing *R. multiflora*, mentions that it is distinct from all other Central American species. He may not have seen either Rusby's description or representative specimens of *R. littoralis*. Except that the leaves are slightly smaller, *R. multiflora* does not show any other significant difference from the type of Rusby's *R. littoralis*. Standley has described *R. macrocarpa* only on fruiting material. I have obtained material from the type locality, through the kindness of Mr. A. M. Bouché, and have given particular attention to the fruits. *R. littoralis* fruits profusely, and occasionally giant fruits have been noticed. It may also be significant that seeds of *R. macrocarpa* which I have dissected were found sterile. I am convinced, therefore, that the type specimen of *R. macrocarpa* is only an abnormal specimen of *R. littoralis*. I am accordingly putting it in synonymy.

COLOMBIA: ATLANTICO: Baranoa, *Dugand 4549* (US); Barranquilla, vicinity of Las Pendales, *Elias 1543* (F, MO, US). BOLIVAR: Manati, *Dugand 591* (F). MAGDALENA: Magdalena, *Dugand & Peten 398–842* (F); Santa Marta, *Smith 1905* (A, F, G, GH, L, MO, P, S, US), *1906* (A, F, G, GH, L, NY, P, S, US). VALLEE DEL CAUCA: Coli *Soto Herrera 941* (US).

COSTA RICA. PUNTARENAS: San Rafael de Esparta, *León 4499* (MO).

ECUADOR. MANABI: El Recreo, *Eggers 15531 = 15568* (F, K, M, MO, S, US).

PANAMA. CANAL ZONE: Cocoli, *Riley 125* (MO, US); *G. White 120* (MO); Miraflores, Gorgas Memorial Lab., *P. White 130* (MO, US), west end of island, vicinity of lake, *137* (MO). CHIRIQUI: Progreso, *Cooper & Slater 200* (A, F, US).

3. RAUVOLFIA TETRAPHYLLA L. Sp. Pl. 208. 1753. (T.: *Linn. Hb., photo 293.4!*)

R. hirsuta Jacq. Enum. Pl. Carrib. 14. 1760; Select. Stirp. Am. Hist. 47. 1763, *ex char.*
R. tomentosa Jacq. *l.c. ex char. et icon.*
R. canescens L. Sp. Pl. ed. 2. 303. 1762, *ex char., non R. canescens* Descourt. Fl. Ant. 3:151. 1827.
R. subpubescens L. Mant. 2:345. 1771, *ex char.*
R. heterophylla R. & S. Syst. Veg. 4:805. 1819, *ex char.*
R. canescens var. *glabra* Muell.-Arg. in Linnaea 30:395. 1860. (T.: *Bertero s. n.!*)
R. canescens var. *tomentosa* Muell.-Arg. *l.c.* (T.: *Goudot 2!*).
R. latifolia var. *minor* Muell.-Arg. *l.c.* 396 (in part as to *Jameson 514!*)
R. heterophylla var. *puberula* A. Gray, in Proc. Am. Acad. 5:187. 1861, *nom. nud.*
R. odontophora Heurck & Muell.-Arg. in Heurck, Obs. Bot. 150. 1870. (T.: *Spruce 6302!*)
R. canescens var. *intermedia* Mgf. in Fedde, Rep. Spec. Nov. 20:115. 1924, *in clave.*
R. canescens var. *typica* Mgf. *l.c., in clave.*
R. mollissima Mgf. *l.c.* 119. (T.: *Tonduz 13940!*)
R. hirsuta var. *glabra* (Muell.-Arg.) Woodson, in Ann. Mo. Bot. Gard. 26:299. 1939.

Sub-shrubs and shrubs with milky latex, 0.5–1.5 m. tall; branches 2-, 3- or 4-chotomous, terete, softly pubescent to glabrous, the nodes with interpetiolar, linear, deciduous stipules and pectinate glands in the axil and on the petiole. LEAVES in whorls of 4, rarely 3 or 5, strikingly anisophyllous, shortly petiolate, very variable in shape, ovate, ovate-elliptic, or oblong-elliptic to obovate-elliptic, acute to obtuse and broadly acute to obtuse at the base, the largest leaves at the node 5–15 cm. long, 2–4 cm. broad, the smallest 1–4 cm. long, 0.8–3.0 cm. broad,

membranaceous, glabrous to tomentulose on both surfaces, secondary veins distinct to obscure, arcuate, 5–12 pairs, the vein network distinct or obscure, extremely close-knit when distinct; petiole 2–5 mm. long. INFLORESCENCES terminal and lateral, few- to rarely many-flowered; peduncles slender, 1–4 cm. long, rarely 2- to 3-branched, glabrous to puberulent, minutely bracteate, the pedicels slender, 2–5 mm. long, glabrous to puberulent. Flowers small; calyx deeply 5-lobed, the lobes ovate, acute, about 1 mm. long, glabrous to puberulent without and glabrous within, corolla urceolate, white, the tube slender, 2–3 mm. long, glabrous to puberulent without and rather densely villous within near the throat, the throat slightly constricted, the lobes obovate to subrotund, rounded, about 1 mm. long; stamens

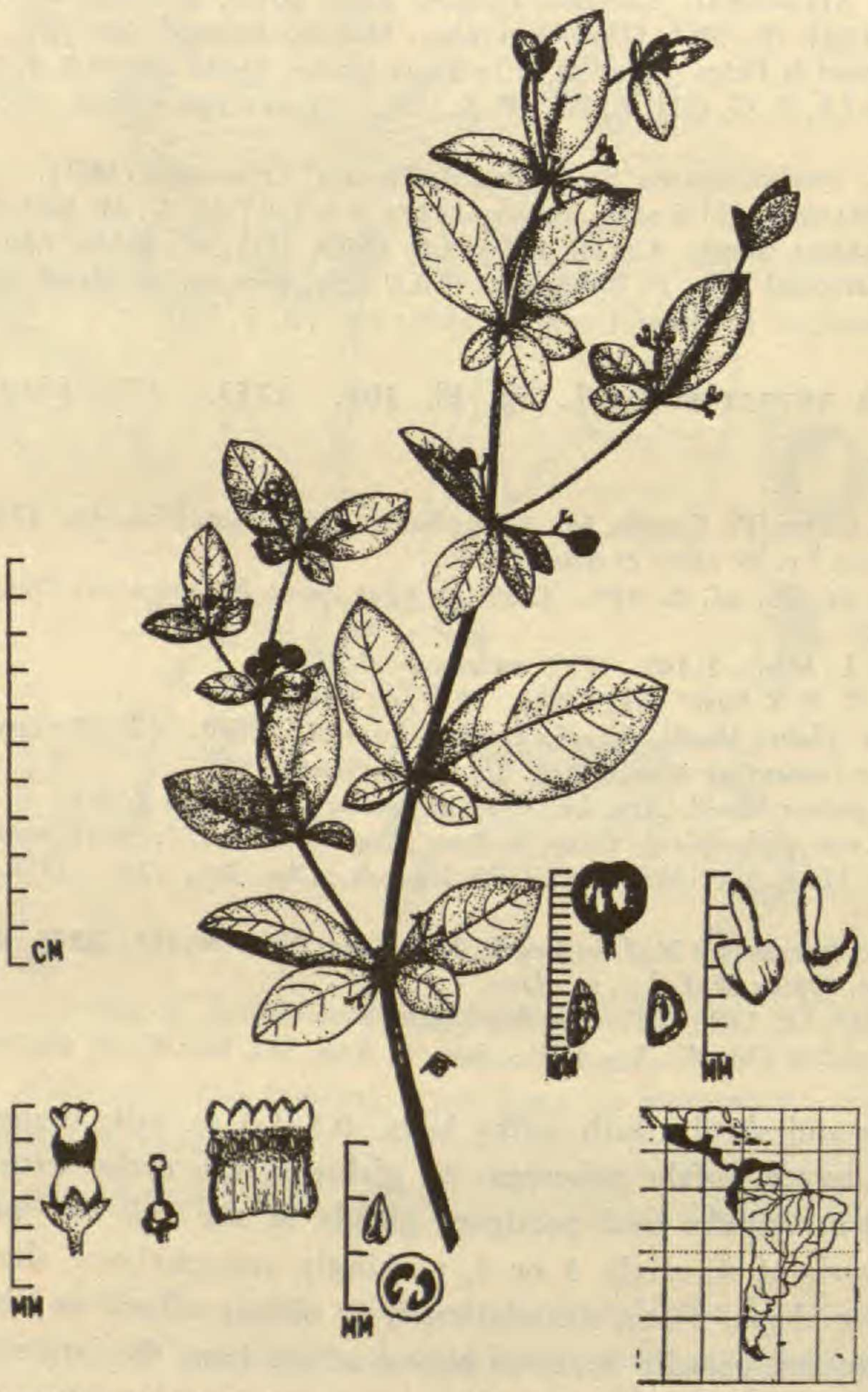

Fig. 3. *Rauvolfia tetraphylla* L. From living plant at the Missouri Botanical Garden.

5, included, inserted near the throat, the anthers ovate, acute, about 1 mm. long, the filament about 0.5 mm. long; ovary 2-carpellary, syncarpous, subspherical, about 1.5 mm. high and 2 mm. in diameter, the ovules 1–2 in each locule on an axile placenta, the disc annular, 0.5 mm. broad, the style slender, 1.5–2.0 mm. long, glabrous, the stigma-head subcapitate, about 1 mm. high, obscurely bi-apiculate. FRUITS spherical to subspherical, 5–8 mm. in diameter, glabrous, gradually turning from green to red and black as they ripen, 2-seeded, the stones ovoid, flattened ventrally, convex dorsally, distinctly rugose; seeds ovate, slightly curved, albuminous, testa membranaceous, the albumen carnose, the embryo deeply arcuate, the cotyledons cordate-ovate, obtuse, 2.0–2.5 mm. long, the hypocotyl terete, about as long as the cotyledons.

Plants of extremely varied habitat, near road-sites, in waste places, on hills, on lake banks, on rocky cliffs, in dry fields and in hedges, in moist rich soil in full sun or under shade of trees; at altitudes from sea-level to about 2,000 meters. Flowering and fruiting practically throughout the year. I have noticed in the greenhouse, young plants scarcely 3–4 months old bearing flowers. Greater Antilles, Mexico to Colombia, Ecuador, Peru and Venezuela.

COMMON NAMES: Colombia—*Anguito, Cruceto, Venenito.* Costa Rica—*Chalchupa, Cohataco, Guataco.* El Salvador, Nicaragua, and Panama—*Amatillo, Comida de Culebra, Guataco, Hierba de San Jose,* and *Señorita.* Mexico—*Coralilla, Corazillo,* and *Corralio.* Venezuela—*Boboro.*

R. tetraphylla can be distinguished from its related species by its very unequal leaves with usually obscure secondary nerves, the mostly lateral few-flowered inflorescences much shorter than the leaves, and the small flowers with acute calyx-lobes. It has been often confused with *R. nitida* Jacq., particularly in the Antilles, but differs from it in having dull leaves with few arcuate secondary veins, the inflorescences with slender, rarely branched peduncles, and the flowers with acute calyx-lobes.

The confusing nomenclatorial history of *R. tetraphylla* and its clarification by Rendle have already been discussed. The extremely variable leaf characters have occasioned the publication of several specific names for this polymorphic species. I have made a statistical analysis of variation in this species. Any study based on the herbarium material alone or a few plants from the greenhouse cannot be conclusive. *R. tetraphylla* offers a very interesting example for extensive observation in the field and in the botanical garden. This species has been known to have been introduced to India[44] in the last 150 years, and to Australia in the last 50 years or less, and in both countries it has become naturalized. Considering the paucity of information on the behavior of introduced plants in their new homes, a detailed botanical study of this species in these regions should be of great interest.

ANTILLES.—
BARBADOS: St. George, Jordan's estate, *Barrow 154* (NY); *Goodding 380* (NY).

[44] Voigt, *l. c.*

CUBA. CAMAGUEY: Camaguey to Santayana, *Britton 2401* (NY), *N. L. & E. G. Britton & Powell 13271* (MO, US); Cayo Guajaba, *Shafer 2847, 2853* (NY, US); vicinity of Tiffin, *2886* (NY, US). HAVANA: Havana, *Baker 5130* (NY, US); vicinity of Cojimar, *Britton, Earl & Wilson 6234* (NY), *Britton, Earle & Gager 6276* (NY), *Palmer & Riley 840* (US), *Ekman 348, 825, 944, 13419, 16892* (S), *Leon 1337, 5201* (NY), *Shafer 173* (NY), *Van Hermann 908* (NY, US), *Wilson 1369* (NY); Santiago de las Vegas, *Cook 91* (US). ISLE OF PINES: Nueva Gerona, *Curtiss 517* (A, G, GH, L, M, MO, NY, P, S, US). MATANZAS: Matanzas, near mouth of the Bueyoaca, *Britton & Wilson 32* (NY), *N. L. & E. G. Britton & Shafer 549* (NY). ORIENTE: Cupey, *Ekman 6301* (P); vicinity of Daiquiri, *Britton & Cowell 12688* (NY); Iguabo, *Eggers 5411* (P); Santiago de Cuba, *Havard 68* (NY), *Leon 138, 12366* (NY), *Gonzalez de Moya s.n.* (MO); Pico Turquino, south slopes, *Seifriz 1010* (US); Yara to Manzanillo, *Shafer 12330, 12386,* along Río Canto, *1647* (NY, US), *Underwood & Earle 130* (NY); precise locality not known, *Ekman 5679, 7963, 9760* (S). PINAR DEL RIO: Bay of Mariel, *Britton & Earle 7582* (NY); Corrientes Bay, *Britton & Cowell 9976, 9976A* (NY); vicinity of Guane, *N. L. & E. G. Britton & Cowell 9749* (NY), *Shafer 10381* (MO, NY, US); Herradura, *N. L. & E. G. Britton, Earle & Gager 6323* (NY, US), *Van Hermann 706* (NY, US); Los Acostos, *Zanna Gutia 5272* (NY); vicinity of Sumidero, *Shafer 13410* (NY, P, US). SANTA CLARA (LAS VILLAS): Cienfuegos, *Combs 81* (GH, MO, NY, P, US), *Hodge & Howard 4139* (GH), *Jack 4661* (A, US), *5232, 5555* (A, P), *7297* (A); Jagua, *Howard, Briggs, et al. 253, 392* (UC); Bahia de Cochinos, *Leon 9563* (NY). PRECISE LOCALITY NOT KNOWN: *Rugel 389* (L, MO, NY), *Sagra s. n.* (W), *Sessé, Moçiño, Castillo & Maldonado 5066, 5067* (F), *Wright 2942* (A, G, GH, MO, P, S, W).

DOMINICAN REPUBLIC: Barahoña, *Miguel Fuertes 238* (GH, L, P, NY, S, US, W); Llano Castero, in thickets, *Ekman 12465* (S); precise locality not specified, *Bertero s. n.* (P), *Ehrenberg s. n.* (NY), *Poiteau s. n.* (G, P), *Von Jacquemont s. n.* (P).

HAITI: Artibonite, *Ekman 8535* (S, US); Dame-Marie, *Ekman 10452* (S, US); Ennery, *E. C. Leonard 8914* (NY, US); Fond Parisien, *E. C. Leonard 4145* (GH, NY, US); Gauthier, *E. C. Leonard 872* (NY, US); Gros Morne, *E. C. Leonard 9912* (GH, UC, US); Jacmel, *Favrat 38* (G); Jean Rabel, *E. C. & G. M. Leonard 13705* (US); Massif de la Hotte, *Ekman 8575* (S); Miragoane & vicinity, *Eyerdam 434* (GH, P, US); Plaisance to Gonaives, *Nash & Taylor 1522* (NY); Tortue Island, La Vallée, *E. C. & G. M. Leonard s.n.* (A, GH, US); precise locality unknown, *Jaeger s. n.* (GH, M, P, S, UPS, W).

JAMAICA: precise locality unknown, *Boos s. n.* (W); *Swartz s. n.* (M, S, W).

SAINT THOMAS: precise locality not known, *Perrin s. n.* (NY).

TRINIDAD: *Trinidad Botanic Garden Herbarium 3570* (US); road to Galera Point, *Broadway 2746* (S); St. Anne's, *Broadway 9229* (A, MO), *Fendler 636* (P), *Freeman 8879* (MO). TOBAGO: *Thiebaut 1223* (P).

CENTRAL AMERICA.—

BRITISH HONDURAS: Belize, *Gentle 36* (F); Corozal, *Gentle 495* (MO); El Cayo and vicinity, *Chanek 120* (F).

COSTA RICA. GUANACASTE: camino de Concepción, *Echeverria 4166* (UC); El Coyolar, *Standley s. n.* (US); Filadelfia, *Echeverria 284* (UC); Guachipelín, *Kupper 1424* (M); Isla de Cabello, *Brenes 15695* (F); Isla de San Lucas, *Quinos 789* (F); La Cruz, *Morley 761* (MO, UC, US); Las Cañas, *Standley & Valerio 46663* (US), *466689* (US); Los Loros, *Brenes 21467* (F). PUNTARENAS: Puntarenas, *Beetle 26225* (UC, US), *Brenes 12365* (F), *Howell 10155* (US), *León 502* (F), *Maxon & Harvey 7857* (US), *W. W. & H. E. Rowlee 123, 124* (US); *Stork 528* (US), *3397* (F); San José, *Tonduz 13916* (P, US); precise locality not known, *Krukoff s. n.* (MO); Canton de Osa, vicinity of La Presa, *Allen 5287* (P, UC, US), vertiente del Pacifico, *P. Birlley fil. 17342* (US).

GUATEMALA. ALTA VERAPAZ: La Libertad, *Lundell 2493* (MO), *3399* (MO, S), *Mercedes Aguilar 138* (A, MO). CHIMALTENANGO: Patzún, *Heyde & Lux 6417* (G, F, M, MO, US). ESCUINTLA: Anubis, near Obispo, *Muenscher 12371, 12601* (F), Escuintla, *Pacheco s. n.* (F), *Pedro Pirales 2046* (US), *Morales Ruano 544* (US); Chichipin, *Morales Ruano 551* (US); San José, *Standley 64227* (F); Las Fianzas, *Salas 363* (US). GUATEMALA: *Ruehl s. n.* (MO, US), *Merck & Co. s. n.* (MO). HUEHUETENANGO: Agua

Caliente (Quezaltenango), *J. M. & M. T. Greenman 5958* (MO); vicinity of Cuilco, *Steyermark 50757* (F); Nentón, Sierra de los Cuchumatanes, *Steyermark 51431* (F, MO). JALAPA: Jalapa, *Kellerman 8059* (F). JUTIAPA: Jutiapa, *Standley 75129* (F, MO), *75990* (F). RETALHULEU: Ayutla, *Standley 68829* (F); Retalhuleu, *Bernoulli & Cario 1835* (S), *Standley 66786.* SAN MARCOS: Ocós, *Steyermark 37825* (F), Río Naranjo, *Rojás 175* (US). SANTA ROSA: Chicquimulilla, southeast, *Standley 78858* (F, MO); Guazacapán, *Standley 78703* (F, MO); vicinity of Taxisco, *Standley 79011* (F, MO). SUCHITEPEQUEZ: vicinity of Tiquisate, *Steyermark 47717* (F). ZACAPA: Gualan, *Blake 7684* (US), *Deam 6287* (A, F, MO, US, W); trail between Río Hondo and waterfall, *Steyermark 29489* (F, MO); Zacapa, *Standley 72027* (F), *73654* (F, MO).

HONDURAS. COMAYAGUA: Comayagua, *Williams & Molina 14680* (F), *Standley & Chacon 5351* (F); El Bano, *J. Valerio Rodriguez 2320, 2399* (F). CORTES: Barbara, *Molina 3866, 3867* (F); La Lima, *Johansen 37* (F, MO, US), *Williams & Molina 12470* (F); Progreso, near San Pedro Sula, *Hottle 69* (F); San Pedro Sula, *Bangham 333* (A); FRANCISCO MORAZAN: between Suyapa & Tegucigalpa, *Standley 14200* (F); Tegucigalpa, *Fogg 21751* (MO); Río Yeguare, *Galsman 1600* (F), *Williams & Molina 13266* (F, MO, US); Zamorano, *Molina 30* (F), *J. Valerio Rodriguez 230* (F), *1241* (F), *Standley 1304, 3896* (F), *Williams 14070* (F). OLANCHO: vicinity of Catacamas, *Standley 18186, 18374* (F). VALLE: Amapala, *J. Valerio Rodriguez 3353* (F, MO); vicinity of Amapala, *Standley 20765* (US). YORO: Aguan River valley, *Yuncker et al. 8078, 8655* (F, MO, P, S, US).

EL SALVADOR. AHUACHAPAN: vicinity of Ahuachapan, *Standley 20219* (US). LA LIBERTAD: vicinity of Ateos, *Standley 23332* (US); near Comasagua, *Carlson 260* (F, UC), *552* (F). LA UNION: Acajutla, *Stork, Eyerdam & Beetle 8732* (A, P, UC), *Standley 21935* (S, US); vicinity of La Union, *Beetle 26262* (A, MO, P, UC, US), *Standley 20783* (S, US); Laguna de Maquigue, *Standley 20981* (US). SAN SALVADOR: Apulo, *Williams & Molina 16760* (F, US); along the road from San Martin to Laguna de Ilopango, *Standley 22558* (US); vicinity of Tonacatepeque, *Standley 19529* (US); Cerro de San Jacinto, near San Salvador, *Standley 20601* (US), *Velasco 9006* (US), *Salvador Calderón 348* (US). SANTA ANA: vicinity of Metapán, *Standley & Padilla Y 3033* (F). SAN VICENTE: vicinity of San Vicente, *Standley 21309* (US). SONSONATE: Acajutla, *Standley 21935* (S, US), *Stork, Eyerdam & Beetle 8732* (A, P, UC), vicinity of Armenia, *Standley 23440* (US); Nahuizalco, *Hartman 20, 63* (S); Sonsonate, *Standley 21761* (US). PRECISE LOCALITY UNKNOWN: *Renson s. n.* (US).

NICARAGUA. CARAZO: vicinity of Jinotepe, *Standley 8490* (F). CHINANDEGA: Ameyer, *Maxon, Harvey & Valentine 7104* (US) *Maxon et al. 7156* (US); Chichigalpa, *Standley 11306, 11396* (F). CHONTALES: Juigalpa, *Standley 9376* (F). GRANADA: Granada, *Baker 173* (MO, UC), *608, 846,* (US), *Levy 214* (P, W), *Maxon et al. 7613* (US); Momotombo, *Baker 215* (MO), *667* (US), *C. L. Smith 127* (MO, UC, US). ESTELÍ: vicinity of Condega, *Standley 20402* (F). MANAGUA: Managua, *Chaves 88* (A), *Garnier 328* (MO), *J. M. & M. T. Greenman 5687* (MO), *Maxon et al. 7221* (US), *7282, 7545* (US); Laguna de Masaya, *Maxon et al. 7740* (US); Cosiguina Volcano, *Howell 10257* (F); Ometepe Island, Lake Nicaragua, *Shimek & Smith 73* (US), *C. L. Smith s. n.* (UC). PRECISE LOCALITY UNKNOWN: *Wright s. n.* (P).

PANAMA. PANAMA: Canal Zone, *Bouché s. n.* (MO), *Celestine 57* (US), *Standley 25546* (A, US); Juan Diaz, *Standley 30471* (US); Panama City, *J. M. & M. T. Greenman 5145* (MO); Panama Vieja, *Asplund s. n.* (UPS), Panama Vieja to Bella Vista, *Allen 831* (F, MO, P, US); Taboga Island, *Standley 27100, 27851* (US), *Woodson, Allen & Seibert 1530* (A, MO).

MEXICO. CAMPECHE: Campeche, *Fogg 21759* (MO); Hopelchen, *Fogg 21760* (MO). CHIAPAS: Acapetahua, *Matuda 16506* (F); Acacoyagua, Escuintla, *Matuda 16423* (F); Paderón, *Matuda 16896* (F); southeast of Puerto Arista, *Morley 716* (MO, UC). COLIMA: Armeria, *Jones 342* (MO), *Palmer 86* (A, F, MO, P, UC, US); Colima, *Palmer 106* (US); Manzanillo, *Eyerdam & Beetle 8711* (A, MO, P, UC), *Palmer 1030* (US), *West 3515* (UC); Paso del Rio, *Emrick 186* (F). GUERRERO: Acapulco, *Palmer s. n.* (US); Aca-

pulco, sea cliffs, *Clark 7172* (MO); Guerrero, *C. L. Smith 6018* (A, MO, P); Iguala, *J. N. & J. S. Rose & Painter 9305* (MO, US); Mazatlán, *Stork & Horton 8606* (MO, P, UC); San Luis, *Hinton 10874* (A, MO, P); Pungarabato, Coyuca, *Hinton et al. 5799* (F); south of Taxco, *Clark 7105* (MO). JALISCO: La Palma, *Jones 66* (MO, US). MEXICO: Amatepec, *Matuda 31291* (MO); Tamacaltepec, *Hinton 724* (F, MO, US), *Hinton et al. 3582* (US), *Hinton 3826* (P); San Luis de Turrubales, *S. Jimenez Canossa 2* (F); Maria Madre Island, *Octavis Solis 89* (US), *Mason 1839* (US); Mexico, *Wawra 89* (W). MICHOACAN: Apatzingan, *Hinton 12028* (US), *Leavenworth 475* (F, MO), *Leavenworth & Hoogstraal 1352* (F, MO). NAYARIT: Acaponeta, *Rose, Standley & Russell 14280* (US); vicinity of San Blas, *Roxana S. Ferris 5324* (A, US). SAN LUIS POTOSI: Rascon, *Purpus 5309* (F, MO, UC, US); Tamasopo, *Pringle 5068* (G); Tamazunchale, *Kenoyer s. n.* (MO), *Stanford 6938* (UC); Valles, *Kenoyer A641* (MO), *Vines 3326* (US). SINALOA: Culiacán, *Brandegee s. n.* (UC, US); Copradia, *Brandegee s. n.* (UC); Guadalupe, *Rose 14680* (US); Labrados, *Ferris & Mexia 5208* (A, F), *Mexia 940* (A, UC, US); Imala, *Gentry 4955* (MO), *Palmer 1437* (US), *1439* (F, UC), *Ortega 4167* (US); Mazatlán, *MacDaniels 30* (F), *Ortéga 7013* (F, P), *7210* (F, MO, P), *7360* (F), *7482* (MO), *Rose 14032, s. n.* (US); Rosario, *Rose 1575, 14622* (US); San Juan, *Ortéga 4023, 4126* (US); Santa Fe, *Ortéga 4678* (US). PUEBLA: Tlaxcoapan, *Hahn s.n.* (P); Xochiltepec, *Lyonnet 2185, 2655* (US). VERA CRUZ: Antigua, *Purpus 6143* (F, MO, UC, US); Ojapa, *Orcutt 5193* (MO, US); Papantla, *Liebmann 15135* (MO, UC, US); Pueblo Viejo, *Palmer 421* (F, MO, US); Río de Santa Maria, *Purpus 2016* (UC, US); Rinconada, *Ross s. n.* (MO); San Francisco, *C. L. Smith 1336* (UC); Vera Cruz, *Galleotti 7114* (P); Wartenberg, near Cartoyuca, *Ehrenberg 1858* (P). OAXACA: Cuicatlán, *Conzatti 3991* (US), *Nelson 1872* (US); Oaxaca, *Arson s. n.* (L, S), *Conzatti 2165* (F), *Pringle 4580* (G), *4861* (M, MO, P, UC, US, W); San Geronimo, *Purpus 7147* (A, F, MO, UC, US); Tehuantepec, *Orcutt 3455* (F, MO, US); Tomelin, *C. L. Smith 855* (MO, UC, US); Tuxtepec, *Martinez-Calderón 90* (MO, UC, US). YUCATAN: Campeche, *Fogg 21757* (MO), *C. L. Lundell 900* (F, MO, UC, US); Cabal, *Steggerda 16* (F); Chichankanab, *Gaumer 1490* (F), *1869* (A, F, MO, UPS, US); Itza, *C. L. & A. A. Lundell 7464* (MO, US), *Steere 1104* (MO), *1363* (F); Izamal, *Gaumer 610* (A, F, MO); Mérida, *Schott 431* (F); precise locality not known, *Lundell 4768* (A, F), *Fogg 21765* (MO), *Gaumer 24047* (F, MO, P, US).

SOUTH AMERICA.—

BRITISH GUIANA. Georgetown Botanical Garden, *Dahlgren & Persaud s. n.* (F).

COLOMBIA. BOLIVAR: Cartagena, *Billberg 205* (S), *Cufodontis 31* (W), *Killip & Smith 14161* (A, GH, US), *Schott 851* (F); Cienaga, *R. R. Castañeda 984* (MO); Turbaco, *Killip & Smith 14191* (A, GH, US), *Pennell 4759* (F, GH, K, MO, US). CAUCA: Dagua, *Lehmann 5091* (F, GH), *Pennell 5265* (GH, US). CUNDINAMARCA: Bogotá, *Cespedel s. n.* (P), *Triana s. n.* (P). HUILA: Neiva, *Perez-Arbelaez 735* (MO, US). MAGDALENA: Magdalena, near Codazzi, *Haught 2316* (A, MO, US), *Pittier 1574* (US); Sierra Nevada de Santa Marta, *Barkley 18 C 511* (MO); Santa Marta, *Bertero s. n.* (P), *Juan Giacometto 1027* (MO), *Purdie 407* (P), *H. H. Smith 1648* (A, F, GH, L, MO, P, S, US), *1649* (F, GH, MO, P, US), *1654* (P), *2097* (A, F, GH, L, MO, P, S, UC, US). SANTANDER: Santander, *J. A. Molina & Barkley 18 S 256* (MO). PRECISE LOCALITY UNKNOWN: *Karsten 17b* (W).

ECUADOR. GUAYAS: Salao, *Eggers 14535* (M, S, US); Guayaquil, *Anderson s. n.* (S), *Asplund 5125* (P, UPS, US), *Jameson 514* (G), *Spruce 6302* (P, S, W). MANABI: Manabi, *Haught 2982* (MO, US), *Solis 10641* (F); Savana ad Faura, *Mille 989* (F).

PERU. AMAZONAS: Bagua, *Diáz s. n.* (MO). LAMBAYEQUE: Chiclayo, *Ramon Ferreyra 7610* (US), *Lopez Miranda 288* (MO, US); Pelillo, *Soukup 4198* (US). LIBERTAD: La Libertad, *A. Raimondi 741* (MO). LORETO: Santa Lucia, *Ule 6805* (L). PIURA: Chaura, between Cauchaque and Buenos Aires, *Ramon Ferreyra 10949* (MO). SAN MARTIN: Huallaga, cerca a Bella Vista, *Ramon Ferreyra 10085* (MO).

VENEZUELA. ARAGUA: *H. Pittier 14038* (US). DISTRITO FEDERAL: Caracas and Puerto Cabello, near El Zigzag, *E. Pittier 75* (US); Catia and Las Trincheras, *E. Pittier 8* (US); Curucuri Valley near Maiquetia, *H. Pittier 13388* (A, F, MO, P, US); Curucuri

vicinity, *H. Pittier 10282* (GH, US); between Caracas and La Guaira, *Rose 21920* (US); La Guaira, *Curran & Haman 854, 886* (GH, US). LARA: Carora, *Jahn 179* (US); Río Tocuyo, *Tamayo 314* (US). MERIDA: El Molino, *Steyermark 56218* (F, MO); Tovar, *Fendler 2206* (GH); MIRANDA: Chaco, *Williams 11189* (F). TRUJILLO: La Cerba, *Reed 961* (US); La Concepción, *Reed 1094* (US); San Pablo de Mendoza, *H. Pittier 13329* (US). ZULIA: Isla San Carlos, *Curran & Haman 800* (GH, US). northern Venezuela, precise locality not known, *Curran & Haman 784* (GH), *803* (GH, US), *Goudot s. n.* (P).

INDIA. MADRAS: Madras, *Woodward s. n.* (MO). UTTAR PRADESH: Dehra Dun, *Bhatnagar s. n.* (MO); Lucknow, *Hiralal s. n.* (MO), *Srivatsava s. n.* (MO).

AUSTRALIA. QUEENSLAND: Brisbane, near Rockhampton, *Simmonds s. n.* (A), *Standish s. n.* (A), cult. *C. S. I. R. O. 5428* (MO).

4. RAUVOLFIA VIRIDIS R. & S. Syst. Veg. 4:805. 1819. (T.: *Humboldt & Bonpland s. n., photo* !)

R. psychotrioides H. B. K. Nov. Gen. et Sp. 3:231. 1819. (T.: *Humboldt 69*!)
R. nitida Lam. Encyc. Tab. 2:304. 1819, *non R. nitida* Jacq. 1760.
R. lamarkii A. DC. in DC. Prodr. 8:337. 1844. (T.: *Bertero s. n., photo* !)
R. latifolia A. DC. in DC. Prodr. 8:339. 1844. (T.: *Sieber 74*!)
R. latifolia var. *minor* Muell.-Arg. in Linnaea 30:396. 1860. (T.: *Sieber 268*!)
R. lanceolata Griseb. Fl. Br. W. Ind. 408. 1864, *nom. nud., non R. lanceolata* A. DC. 1844.

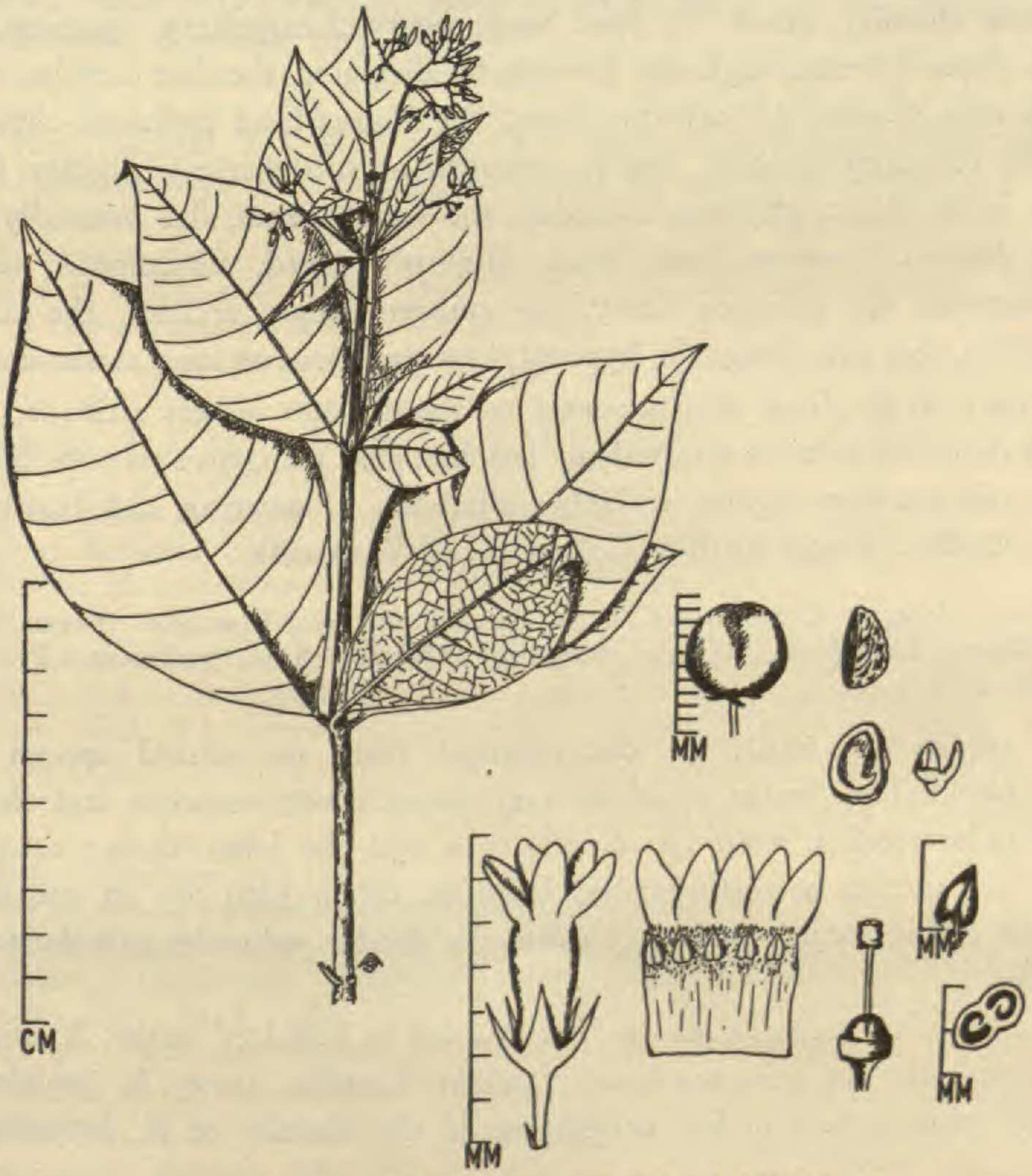

Fig. 4. *Rauvolfia viridis* R. & S. *(Humboldt 69)*

Shrubs up to 2 m. tall; branches terete, puberulent when young, but glabrous later, the nodes with very few pectinate glands in the axil and on the petiole. LEAVES slightly anisophyllous, quaternate, or rarely ternate, shortly petiolate, ovate or broadly ovate-elliptic, acute to acuminate at the tip, tapering at the base, the largest leaves 5–15 cm. long and 3–5 cm. broad, the smallest leaves 2–4 cm. long and 1.5–3.0 cm. broad, membranaceous, glabrous above and minutely puberulent beneath generally or along the midrib and the secondary veins, the secondary veins particularly distinct beneath, sharply arcuate, 8–15 pairs, the tertiary veins and the veinlets forming a distinct network; petiole 2–8 mm. long. INFLORESCENCES terminal or rarely lateral, several- to many-flowered; peduncles slender, 1–4 cm. long, 2- or 3-branched, glabrous or puberulent, minutely bracteate, the pedicels slender, 2–4 mm. long. FLOWERS small; calyx deeply 5-lobed, the lobes ovate, acuminate or cuspidate, 1.0–1.5 mm. long, glabrous; corolla tubular or narrowly urceolate, white, the tube slender, 2.5–3.0 mm. long, glabrous or rarely scantily puberulent without and poorly pilose within near the throat, the throat slightly constricted, the lobes ovate, obtuse, 2.0–2.5 mm. long, about 1 mm. broad, glabrous; stamens 5, included, inserted near the throat, the anthers ovate, acute, about 1 mm. long, the filament distinct, about 0.5 mm. long; ovary 2-carpellary, syncarpous, subspherical, about 1.5 mm. high and 2.0 mm. in diameter, the disc annular, 0.5 mm. wide, the style slender, 1.5–2.0 mm. long, the stigma-head depressed-capitate, 0.5 mm. high, obscurely bilobed. FRUIT spherical or subspherical, slightly flattened, 5–7 mm. in diameter, glabrous, 2-seeded, the stones ovate, flat ventrally, convex dorsally, distinctly rugose; seeds ovate, slightly curved, albuminous, testa submembranaceous, the albumen fleshy, the embryo deeply arcuate, the cotyledons ovate, obtuse, 2–3 mm. long, the hypocotyl terete, about as long as the cotyledons.

Scattered shrubs from near sea-level to about 1000 meters altitude, on coral cliffs and along hill-sides on sandy shady beaches, near mangrove swamps but on dry soil. In arid meadow regions at higher altitudes. Flowering and fruiting from April to October. Lesser Antilles, Colombia and Venezuela.

COMMON NAMES: Colombia—*Cruceto, Mata Penos,* and *Venenito.* Lesser Antilles—*Antigua Balsam, Bitterbush, Billyache, Bois Lait* and *Milky Bush, Snakeberry Tree.* Venezuela—*Bole de Berraco.*

This species can easily be distinguished from its related species by the slightly anisophyllous leaves with the very distinct vein network and the mostly terminal inflorescences, with the corolla-tube and the lobes almost equal in the flowers. It can also be distinguished from *R. nitida* Jacq. by its usually broad leaves with deeply arcuate secondary veins, the slender peduncles and the acuminate calyx-lobes.

McVaugh[45] has recently shown that Roemer & Schultes' name, *R. viridis,* has the priority over the till-now more familiar Kunth's name, *R. psychotrioides.* Markgraf[46] was correct in his recognition of the identity of *R. latifolia* A. DC

[45] McVaugh, R., in Taxon 4:84. 1955.
[46] Markgraf, F., in Fedde, Rep. Spec. Nov. 20:114. 1924.

with *R. lamarkii* A. DC., but yet he maintains *R. lamarkii* as distinct from *R. psychotrioides* mainly perhaps on geographical grounds. The characters that Markgraf used in his key for separating the two species, such as short- and long-acuminate, glabrous or hairy on the midrib, the pilosity in the throat of the corolla, the shape of the stigma-head, all intergrade and cannot be used. The distribution of the species from Puerto Rico to Venezuela and Colombia is nothing unusual.

LESSER ANTILLES.—

ANTIGUA: *Box 872* (MO, UC, US), *Wüllschaegel 342* (M, W).

BARBUDA: northeast of Codrington, *Box 605* (US).

DOMINICA: *Hodge 674* (NY); *Lloyd 829* (NY).

GRENADA: Belair, *Beard 1201* (GH, S, US), *Broadway s. n.* (GH, MO, NY, P); La Pointe, *Eggers 6461* (A, P, US); leeward side of Chatham Bay, *C. P. Cooper III 202* (NY).

GUADELOUPE: Le Moule, *H. Stehle 951* (NY), *981* (P), *H. & M. Stehle 6994, 7022* (US). PRECISE LOCALITY UNKNOWN: *Bena 5337* (US), *Duss 6* (P), *2614* (GH, MO, NY, US), *Forstrom 807* (S), *Perrotet s. n.* (P), *Quentin 213* (P), *L. C. Richard s. n.* (P).

MARTINIQUE: Case Pilote, *Hahn 1503* (P, S), *Mouret 226* (P); St. Anne, *H. & M. Stehle 6164* (US); Valle des Pierre, *Hahn 1459* (G, GH, NY, P, US). PRECISE LOCALITY NOT KNOWN: *Duss 1225* (NY, US), *Sieber 74* (M, P, W).

MONTSERRAT: *Shafer 46* (NY, US).

PUERTO RICE: CULEBRA ISLAND: *Britton & Wheeler 69a* (NY, US). GUAYAMA: Guayama, *Goll et al. 517* (NY). HUMACAO: Fajardo lighthouse, *Heller 1186* (NY, US), *Sintenis 1194* (GH, M, P, S, US), *1195* (P). MAYAGUEZ: Guanica, *Fogg 21775* (MO). PONCE: Ponce to Playa, Las Cucharas, *N. L. & E. G. Britton & Marble 1951* (GH, US); Cayo Muertos, *N. L. Britton, Cowell & Stewardson Brown 504S* (NY, US). SAN JUAN, San Juan, *Sintenis 2806* (L); precise locality unknown, *Plée 610* (P), *Sargent 195* (US), *Underwood & Griggs 628* (NY, US). VIEQUES ISLAND: Cerra Encanta, *Shafer 2541*, vicinity of Isabela Segunda, *Shafer 2560* (NY, US).

ST. BARTHELEMY: *Forström s. n.* (S), *Goes s. n.* (S, UPS), *Questol 228* (NY), *907* (US).

ST. CROIX: *A. E. Ricksecker 407* (GH, MO, NY, UC, US), *J. J. Ricksecker 333* (P), *Thompson 284* (US), *298* (GH, NY, P), *350* (GH).

ST. EUSTATIUS: *Boldingh 1235B* (L), *Suringar s. n.* (L).

ST. JAN: Bethania, hillside woods, *N. L. Britton & Shafer 193* (NY, US).

ST. KITTS: *N. L. Britton & Cowell 254, 351* (NY).

ST. MARTIN: *Boldingh 2361B* (L, P), *Rijgersmaa s. n.* (S).

ST. THOMAS: *Börgeson 27B6B* (S), *66B* (NY), *N. L. & E. G. Britton & Shafer 124* (NY), *N. L. & E. G. Britton & Marble 401, 1296* (NY, US), *Eggers 183* (G, L, M, P, UPS), *Eggers s. n.* (GH, W), *Ehrenberg s. n.* (MO), *Jalmarsson s. n.* (S), *Holton s. n.* (NY), *Poiteau s. n.* (P).

ST. VINCENT: *H. H. & G. W. Smith 557* (GH, NY).

TRINIDAD: *Sieber 268* (MO, P, W); TOBAGO: *Broadway s. n.* (GH, MO, P, US); Buccoo Point, *Cheesman 298* (MO).

VIRGIN ISLANDS: Virgin Gorda, *Fishlock 75* (NY).

SOUTH AMERICA.—

COLOMBIA. ATLANTICO: Barranquilla, *Dugand 125,958* (F), *4822* (MO), *Dugand & Jaramillo 3213, 3217* (US), *Elias 14,189* (US), *Paul C34* (US); Puerto Colombia, *Elias 1014* (F). BOLIVAR: Cartegena, *Dugand & Jaramillo 3374* (US), *Heriberto 38, 354* (US), *Schott s. n.* (F). MAGDALENA: Santa Marta, *Espiña 47* (US), *Perez-Arbelaez 4816, 5860* (US).

VENEUZELA. ARAGUA: Ocumare, *H. Pittier 14035* (US), *Williams 10170* (F). CARABOBO: road from Puerto Cabello to San Felipe, *H. Pittier 8872* (GH, US); Maracay, *Vogel*

1395 (M). DISTRITO FEDERAL: Caracas, *Curran & Haman 1093* (GH, US). MIRANDA: Guatire, *H. Pittier 7844* (GH, US); Santa Lucia, *Holt 548* (P); precise locality not known, *H. Pittier 5979, 11052* (GH, P, US). MONAGAS: Río Caribe, *Curran & Haman 1269* (GH, MO, UC). NUEVA ESPARTA: Isle Margarita, *Johnston 135* (F, G, GH, UC, US, W), *Miller & Johnston 43* (F, GH, MO, P, US). SUCRE: Cristóbal Colón, *Broadway 103, 109* (GH, US); Cumaná, *Humboldt 69* (P); southwest of Cuchivano, *Steyermark 62789* (F, MO). YARACUY: entrance to San Filipe, *Steyermark 55855* (F). ZULIA: Perija, *Tejira 13* (GH, US); Tovar, *Fendler 612* (K, GH, MO); precise locality not known, *Kuntze* v74 (F).

5. RAUVOLFIA MORICANDII A. DC. in DC. Prodr. 8:340. 1844. (T.: *Blanchet 1007!*)

Plants with branches ternate or quaternate, cylindrical or obscurely angular, glabrous. LEAVES ternate or rarely quaternate, slightly anisophyllous, sparsely glandular at base, short-petiolate, narrowly elliptic, caudate-acuminate, gradually attenuate at both ends, entire, 3–8 cm. long, 1.0–2.5 cm. broad, submembranaceous, glabrous, dark green above and pale green beneath, secondary veins delicate, indistinct above, distinct beneath, transverse, many; petioles 2–8 mm. long. INFLORESCENCES terminal, 6- to 15-flowered, peduncles slender, 1–3 cm. long, 2- or 3-branched, bracteate, bracts minute, pedicels filiform, 4–6 mm. long. FLOWERS small; calyx deeply 5-lobed, the lobes deltoid, acuminate, about 1 mm. long; corolla salverform, the corolla-tube slender, 4–5 mm. long, about 1 mm. in di-

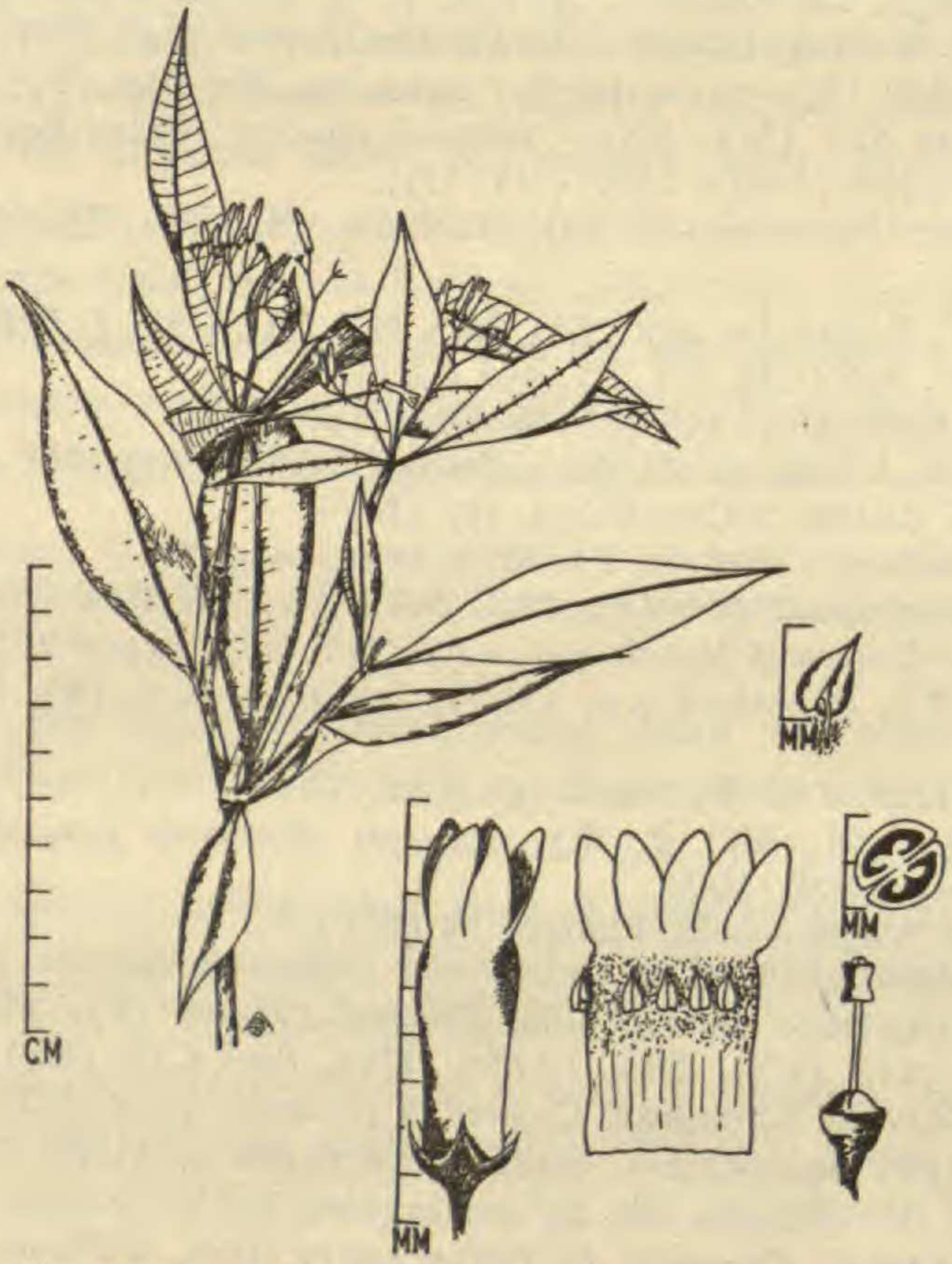

Fig. 5. *Rauvolfia moricandii* A. DC. *(Blanchet 1007)*

ameter at the base, glabrous without, sparsely villous within along the upper half, the throat constricted, the corolla-lobes ovate, obtuse, 2.0–2.5 mm. long, about 1 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acuminate, the filaments short, about 0.5 mm. long; pistil bicarpellary, hemisyncarpous, the ovary subspherical, about 1 mm. high and about 1 mm. in diameter, with 2 ovules in each locule on an axile placenta, the disc annular, narrow, about 0.5 mm. high, the style common, columnar, 2.0–2.5 mm. long, glabrous, the stigma-head subcylindrical, about 1 mm. high, obscurely biapiculate. FRUITS not observed.

Northeast Brazil: Bahia.

This must be a comparatively rare species. Amongst all the material borrowed from the different herbaria, including that of the Rio de Janeiro garden, I have not come across any more specimens of this species. The paucity of the petiolar glands, the rather long corolla-tube, and the hemisyncarpous ovary, characteristic of this species, are exceptional to the section to which it is presently assigned. It is conceivable that with the study of more material this species may well be shifted to the section MACROVOLFIA.

BRAZIL. BAHIA: precise locality not known, *Blanchet 1007* (G).

SERIES 2. **TERNIFOLIAE** A. S. Rao, ser. nov.

Folia in quoque nodo ternata rariusve quaternata, folio majore 3–5 cm. longo. Inflorescentiae folium majorem subaequantes. Species typica: *R. ligustrina* R. & S.

KEY TO THE SPECIES

A. Leaves mucronulate, the largest leaf at each node less than twice as long as broad. Twigs, leaves and peduncles with a fuscous pubescence. Northeastern Brazil. ..... 6. *R. blanchetii*

AA. Leaves acute, the largest leaf at each node more than twice as long as broad. Twigs, leaves, and peduncles glabrous or with a whitish pubescence.

B. Leaves (at least the young ones), young twigs, and peduncles with a whitish pubescence, rarely glabrous. Inflorescences spreading; peduncles 2- or 3-branched, pedicels 5–8 mm. long. Calyx-lobes ovate, acute. Paraguay and south-central Brazil. ..... 7. *R. mollis*

BB. Leaves, young twigs, and peduncles glabrous, or leaves puberulent along the midrib only beneath. Inflorescences rather congested; peduncles unbranched or rarely 1- to 2-branched, pedicels 2–4 mm. long. Calyx-lobes lanceolate, acuminate. Cuba; Mexico to Colombia, Bolivia, Venezuela, and northern Brazil..... 8. *R. ligustrina*

6. RAUVOLFIA BLANCHETTI A. DC. in DC. Prodr. 8:340. 1844. T.: *Blanchet 2718!, 2769!*)

Shrubs; branches 2-, 3- or 4-chotomously branching, terete, fuscous-pubescent, the nodes with very few axillary glands ascending the petiole. LEAVES ternate to quaternate, slightly anisophyllous, shortly petiolate, ovate to ovate-elliptic, acute, mucronulate, abruptly attenuate at the base, 1–4 cm. long, 1–3 cm. broad, membranaceous, glabrous to puberulent above and pubescent beneath, the secondary veins 4–8 pairs, rather indistinct, the vein network hardly distinct; petioles 1–3 mm. long. INFLORESCENCES terminal and lateral, few-to many-flowered; peduncles slender, dichotomously branching, 1–3 cm. long, puberulent, the pedicels slender,

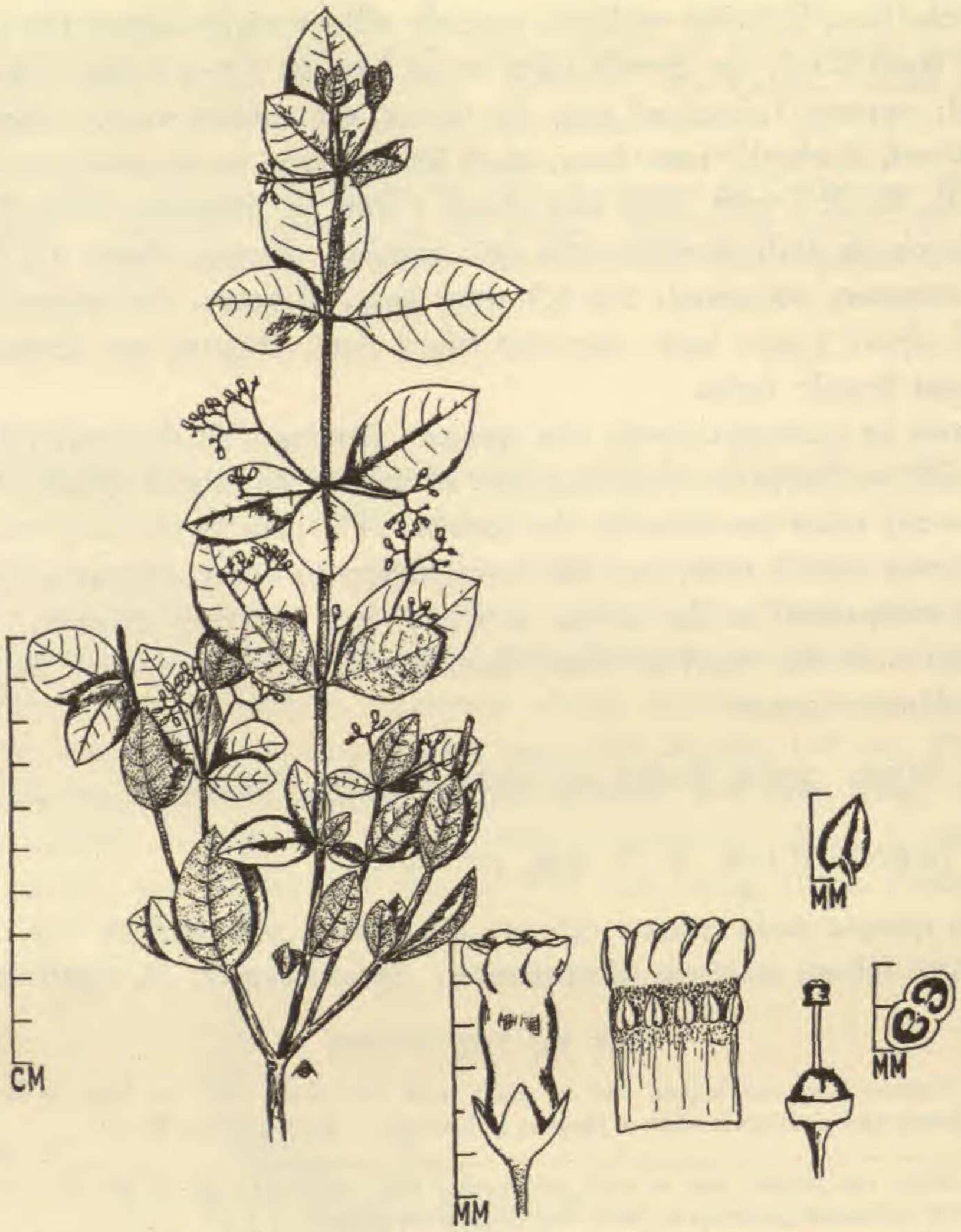

Fig. 6. *Rauvolfia blanchetti* A. DC. *(Blanchet 2718)*

2–4 mm. long, puberulent. FLOWERS small; calyx deeply 5-lobed, the lobes ovate, acute, about 1.5 mm. long, glabrous; corolla tubular or indistinctly urceolate, the tube slender, 2–3 mm. long, glabrous or rarely puberulent without, densely villous within near the throat, the throat scarcely constricted, the lobes ovate to subrotund, obtuse, 1.5–2.0 mm. long, the stamens 5, included, inserted near the throat, the anthers ovate, acute, about 1 mm. long, the filaments distinct, about 0.5 mm. long; ovary 2-carpellary, syncarpous, spherical, about 1.5 mm. in diameter, the ovules 1–2 in each locule on an axile placenta, the disc annular, about 0.5 mm. broad, the style columnar, 1.5–2.0 mm. long, glabrous, the stigma-head subcapitate, about 0.5 mm. high, obscurely bilobed. FRUITS spherical when young, 2-seeded.

I have not seen ripe fruits. Mueller-Argoviensis[47] has depicted mature fruits in his illustration of *R. blanchettii.* The fruits are obviously like those of the other members of this section.

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[47] Mart. Fl. Bras. 6[1]: *tab. 9, fig. 1.* 1860.

This species can be distinguished from all the related species by its fuscous-pubescent twigs, the mostly ternate, ovate-elliptic, mucronate-tipped, puberulent leaves, the inflorescences mostly few-flowered and with dichotomously branching, pubescent peduncles, and flowers with ovate, acute calyx-lobes.

Plants of northeastern Brazil.

BRAZIL. BAHIA: Monte de la Jacobine and Villa de Barra, *Blanchet 2718* (G, F, P), *2769* (G); Joazeiro, *Martinus 2370* (M). ESPIRITO SANTO: Itapemirim, *Glaziou 11183* (P).

7. RAUVOLFIA MOLLIS S. Moore, in Trans. Linn. Soc. Ser. II. 4:393. 1895. (T.: *S. Moore 950, photo*!)

R. divergens Mgf. in Fedde, Rep. Spec. Nov. 20:115, 119. 1924. (T.: *Fiebrig 4664*!)

Shrubs 1–2 m. tall; branches di- or trichotomous, terete, glabrous, or with a whitish pubescence, the nodes with a few axillary glands ascending the petiole.

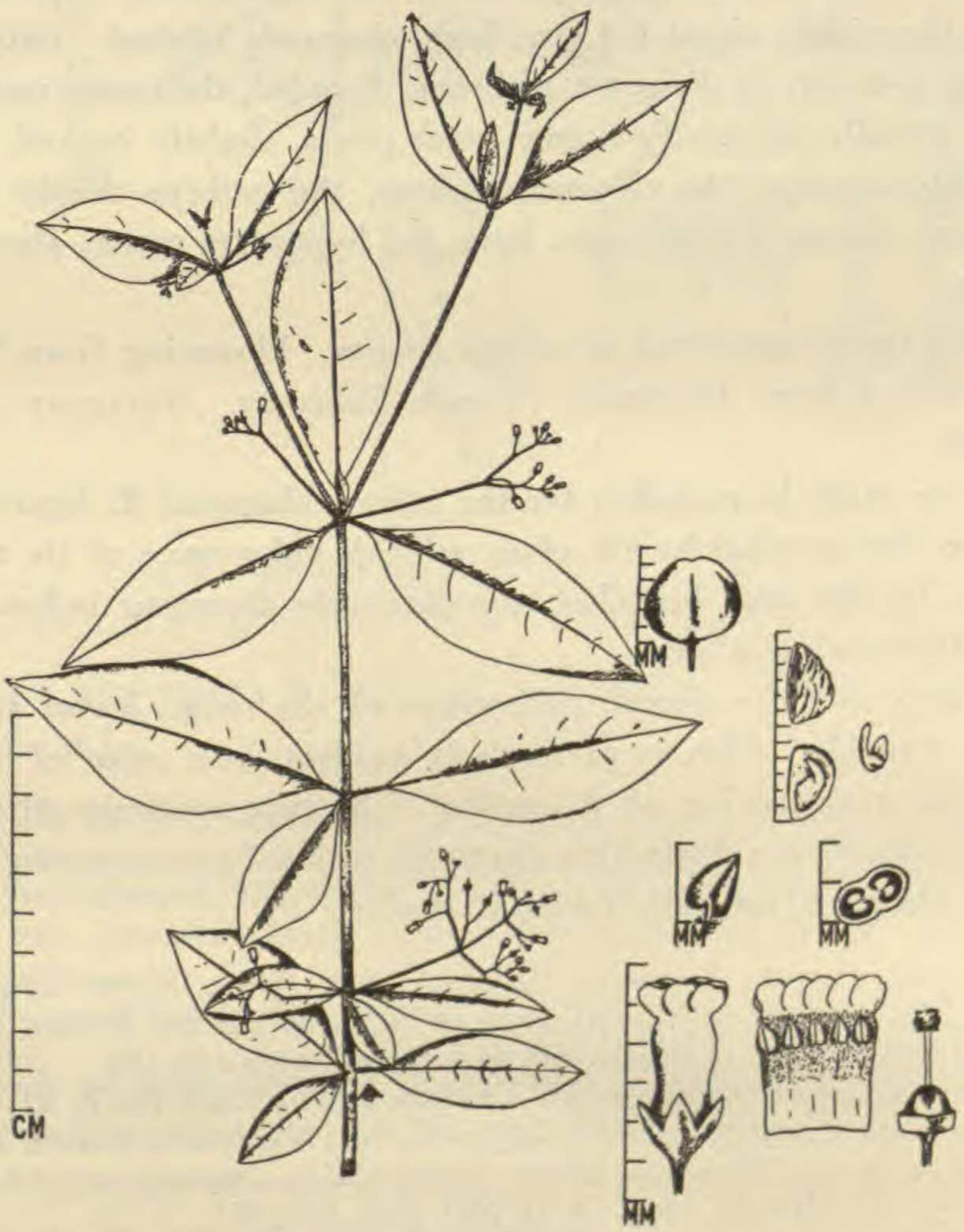

Fig. 7. *Rauvolfia mollis* S. Moore *(E. Hassler 7400)*

LEAVES ternate to very rarely quaternate, slightly anisophyllous, shortly petiolate, ovate-elliptic to narrowly elliptic, acute, attenuate at the base, 1–5 cm. long, 0.5–3.0 cm. broad, membranaceous to subcoriaceous, glabrous above, generally puberulent to puberulent only along the midrib beneath, the secondary veins and the vein network obscure; petiole 1–5 mm. long. INFLORESCENCES terminal and lateral, few- to many-flowered; peduncles glabrous to puberulent, slender, 1–4 cm. long, dichotomously branched, the branches usually divergent, minutely bracteate, the pedicels slender, 5–8 mm. long, glabrous to puberulent. FLOWERS small; calyx deeply 5-lobed, the lobes ovate, acute, 1.0–1.5 mm. long, glabrous or ciliate; corolla urceolate, white; the tube slender, 2.0–3.5 mm. long, glabrous without, villous within near the throat, the throat a little constricted, the lobes obovate to rotund, rounded, 1.0–1.5 mm. long; stamens 5, included, inserted near the throat, the anthers ovate, acute, about 1 mm. long, the filament distinct, about 0.5 mm. long; ovary 2-carpellary, syncarpous, subglobose, about 1.5 mm. in diameter, the ovules 1–2 in each locule on an axile placenta, the disc annular, about 0.5 mm. broad, the style columnar, 1.5–2.0 mm. long, glabrous, the stigma-head depressed-capitate, constricted in the middle, about 0.5 mm. high, obscurely bilobed. FRUITS spherical to subspherical, 4–6 mm. in diameter, glabrous, 2-seeded, the stones ovoid, flat ventrally, bulged dorsally, distinctly rugose; seeds ovate, slightly curved, albuminous, the testa membranaceous, the albumen carnose, the embryo deeply arcuate, the cotyledons ovate, obtuse, 2.0–2.5 mm. long, the hypocotyl terete, about as long as the cotyledons.

In dry fields and in inundated secondary forests. Flowering from September to December; fruiting from December through February. Paraguay and central-southern Brazil.

R. mollis can easily be mistaken for the more widespread *R. ligustrina*. However, it can be distinguished by the often whitish pubescence of its twigs, leaves, and peduncles, by the more branched, conspicuously divergent inflorescences, and the flowers with ovate calyx-lobes.

The leaf shape and the whitish pubescence of the twigs, leaves and peduncles are extremely variable. This is particularly evident in a suite of specimens of Malme from the type locality of *R. mollis*. The type specimen of *R. divergens* Mgf. does not indicate any distinctive character to justify its retention as a distinct species. I am, therefore, merging it with *R. mollis*.

BRAZIL. MATO GROSSO: Corumba, *Hoehne 4280* (US), *Malme 2736* (S, UPS); Cuyaba, *Malme 2679, 2679a* (S); Santa Cruz de Sierra do Rio dos Bugres, *Lindman 2885* (UPS), *A 2885* (S). RIO DE JANEIRO: Rio de Janeiro, *Dusén 139* (S).

PARAGUAY. BOQUERÓN (CHACO): 21° latitude, *Fiebrig 1278* (G, P, S), *1350* (G, P); between Río Apa and Aquidaban, *Fiebrig 4634* (G, K); Villa Sana, *Fiebrig 4664* (G, GH, P, M, S); San Genaro, Isla Margarita, *Meyer 18.600* (MO). PRECISE LOCALITY UNKNOWN: *Anisits 2230, 2655* (S), *Hassler 7400* (A, G, MO, P, S, UC, W).

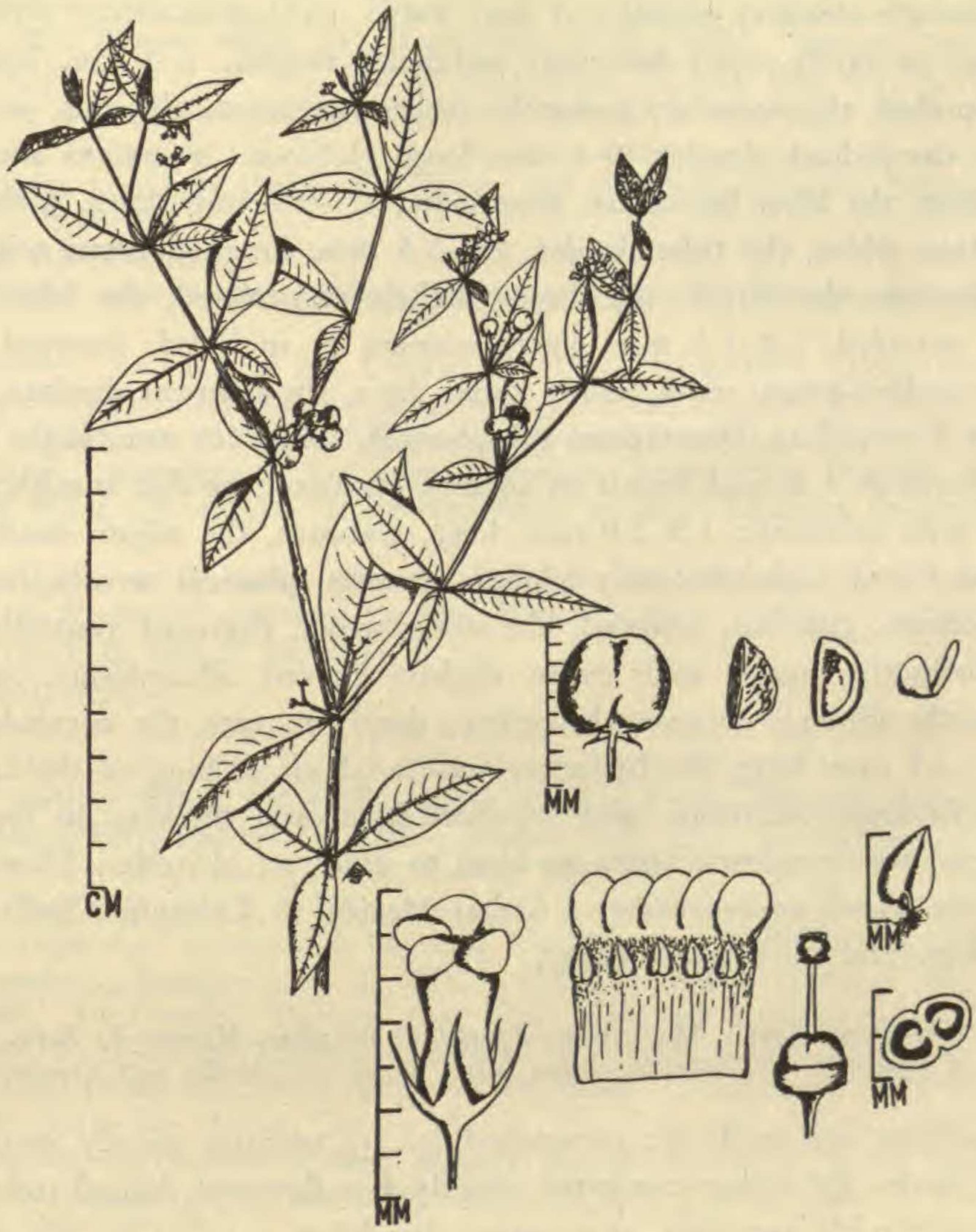

Fig. 8. *Rauvolfia ligustrina* R. & S. *(Humboldt 1480)*

8. RAUVOLFIA LIGUSTRINA R. & S. Syst. Veg. 4:805. 1819. (T.: *Humboldt & Bonpland s. n.*)

R. ternifolia H. B. K. Nov. Gen. et Sp. 3:232. 1819. (T.: *Humboldt 1480*!)
R. parvifolia Bert. ex Spreng. Syst. 1:834. 1825. (T.: *Bertero s. n.* !)
R. parvifolia var. *cubana* A. DC. in DC. Prodr. 8:340. 1844, *nom. nud.*
R. parvifolia var. *tomentella* Muell.-Arg. in Linnaea 30:394. 1860. (T.: *Sieber 326*!)
R. alphonsiana Muell.-Arg. *l. c.* (T.: *Poeppig s. n.*!)
R. indecora Woodson, in Ann. Mo. Bot. Gard. 24:12. 1937. (*Stork 2800*!)

Shrubs 1–3 m. tall; branches dichotomous, terete, glabrous, the nodes with axillary glands ascending the petiole. LEAVES ternate, slightly anisophyllous, shortly petiolate, ovate to ovate-elliptic, acute to acuminate and broadly acute to rarely obtuse at the base, the largest leaves at the nodes 3–5 cm. long, 1–3 cm. broad, the smallest 1–3 cm. long, 0.5–1.5 cm. broad, membranaceous, glabrous or puberulent along the midrib beneath, secondary veins distinct, arcuate, 4–10 pairs,

the vein network obscure; petiole 1–3 mm. long. INFLORESCENCES terminal and lateral, few- to rarely many-flowered; peduncles slender, 1–3 cm. long, 2- or rarely 3-branched, the secondary peduncles rather congested, glabrous, or minutely puberulent, the pedicels slender, 2–4 mm. long, glabrous. FLOWERS small; calyx deeply 5-lobed, the lobes lanceolate, acuminate, 1.5–2.0 mm. long, glabrous; corolla urceolate, white, the tube slender, 2.0–3.5 mm. long, glabrous without and pilose within near the throat, the throat slightly constricted, the lobes ovate to subrotund, rounded, 1.0–1.5 mm. long; stamens 5, included, inserted near the throat, the anthers ovate, acute, about 1 mm. long, the filament distinct, 0.5 mm. long; ovary 2-carpellary, syncarpous, subspherical, about 1.5 mm. high, 2 mm. in diameter, the ovule 1 in each locule on an axile placenta, the disc annular, 0.5 mm. broad, the style columnar, 1.5–2.0 mm. long, glabrous, the stigma-head calyptriform, about 1 mm. high, obscurely bilobed. FRUITS spherical to subspherical, 5–7 mm. in diameter, glabrous, 2-seeded, the stones ovoid, flattened ventrally, convex dorsally, distinctly rugose; seeds ovate, slightly curved, albuminous, testa membranaceous, the albumen carnose, the embryo deeply arcuate, the cotyledons ovate, obtuse, 2.0–2.5 mm. long, the hypocotyl terete, about as long as the cotyledons.

Chiefly in moist situations, near sea-shore in coastal thickets, in river plains, savannas, and wet meadows; from sea-level to 1000 m. altitude. Flowering and fruiting from April to September. Cuba; Mexico to Colombia, Bolivia, Venezuela, Surinam, and northeastern Brazil.

COMMON NAMES: Brazil, Maranhoa—*Paratudo;* Paraiba—*Mamao de Sapo.* Colombia —*Contra* and *Venenito.* El Salvador—*San Jose.* Mexico—*Chirillo* and *Veneno.*

R. ligustrina can easily be recognized by its ternate, mostly ovate-elliptic, acuminate leaves, the rather congested, mostly few-flowered, lateral inflorescences, and the flowers with lanceolate, acuminate calyx-lobes.

Roemer & Schultes' name, *R. ligustrina,* has priority over the Kunthian name *R. ternifolia,* as shown by McVaugh.[48] The several specific names here are mainly due to an inadequate appreciation of variation in leaf characteristics. Markgraf, while correctly recognizing the identity of *R. alphonsiana* with *R. parvifolia,* still maintained the distinction between *R. parvifolia* and *R. ternifolia.* He has used as his key characters leaf size and inflorescence flower-number. Similarly, Woodson differentiates his *R. indecora* "by its nearly isophyllous, subsessile leaves, which are minutely puberulent beneath, and its larger drupes." These characters, however, are very variable and do not help in maintaining the distinctions.

ANTILLES.—

CUBA. HAVANA: Havana, *Baker 2640* (NY, UC), *Leon 7191* (MO, NY), *Leon & Roca 7251, 7252* (MO, NY), *Van Hermann 673* (NY), *Wilson 1345* (A, G, NY, P, UC, US, W). MATANZAS: Matanzas, *Alain 4078* (MO), *Baker 2421* (UC). ORIENTE: Bayate, *Ekman 5927* (S). PINAR DEL RIO: *Roig 1733* (NY), *Shafer 11887* (MO, NY, US). SANTA CLARA (LAS VILLAS): Cienfuegos, *Combs 180* (GH, MO, NY, P, US); Sagua, *N. L.*

[48] McVaugh, R., in Taxon 4:84. 1955.

Britton & Wilson 306, 369 (NY), *Howard 5582* (GH, NY); Santa Clara, *Baker 4963* (NY, UC, US), *Ekman 16859* (S), *Leon 9223, 9447* (MO). PRECISE LOCALITY UNKNOWN: *Poeppig s. n.* (L, P, W), *Wright 2943, 2944* (G, GH, MO, NY, P, S).

TRINIDAD: Moruga, coastal thicket, *N. L. Britton & Broadway 2460* (GH, US), *Broadway 2263* (G), *2680* (G, US), *9010* (A, MO), *9265* (A, G); St. Augustine, *Baker 1* (MO). PRECISE LOCALITY UNKNOWN: *Sieber 326* (P, MO), *Trinidad Botanical Garden 2772* (US).

CENTRAL AMERICA.—

COSTA RICA. GUANACASTE: Bebedero, *Brenes 12579* (F); Nocoya, *Jorge León 4286, 4287* (MO).

EL SALVADOR. LA PAZ: La Paz, *Choussy 19* (US). LA UNION: Laguna de Maquigue, *Standley 20910* (US). SAN MIGUEL: Laguna de Olomega, *Standley 20996* (US), *Tucker 949* (US). SONSONATE: Acajutla, *Salvador Calderón 1654* (US).

GUATEMALA. ESCUINTLA: San Jose, *Kellerman 4570* (US), *Standley 64198* (F, MO), *Merck & Co. s. n.* (MO). SUCHITEPEQUEZ: south of Tiquisate, *Steyermark 47806* (F).

MEXICO. CHIAPAS: Paderon, *Matuda 16273* (F, MO), *16927* (F), *2734* (A, MO, US), *2687* (A, F, MO). OAXACA: Oaxaca, *Matuda extra 5* (MO). JALISCO: Tuxpán, *Mexia 1042* (A, F, G, MO, P, UC, US).

SOUTH AMERICA.—

BOLIVIA. BENI: Río Madre de Dios, *Kuhlmann 581* (RB); junction of R. Beni and R. Madre de Dios, *Rusby 2388* (F, GH, MO, W), *2389* (F, GH, P, US).

BRAZIL. BAHIA: Bahia, *RB 47482* (RB). CEARA: Ceara, *Allemão 974* (P), *Drouet 2707* (F, GH, S, US), *Ducke s. n.* (RB), *Hoehne 7544* (F). MARANHAO: *Ducke s. n.* (RB), *Hoehne 3430* (F); near Lorenda, *Krukoff 2047* (A, F, G, M, MO, S, US). PARA: Montelegre, *Ducke 23* (P, RB, S, US). PARAIBA: *J. C. de Moraes 890* (MO), *Xavier 103* (MO). PERNAMBUCO: Fernando de Noronha, *Mosley s. n.* (P), *Ridley, Lea & Ramage 83* (GH); Pernambuco, *Gardner 1063* (G, GH, S, US, W). PIAUÍ: *Netto 40* (F).

COLOMBIA. ATLANTICO: *Dugand 4541* (US), *Dugand & Bariga 2307* (US), *Elias 1425* (F, MO, P, US); Río Magdalena, *Dugand & Jaramillo 2748, 3262* (US); Barranquilla, *Elias 1076* (F, G, MO, US). BOLIVAR: Cartagena, *Otto 804* (W); Florencia, *Perez Arbelaez 636* (US); San Martin, *Curran 28, 75* (GH, US), *408* (GH), *Dugand 528* (F, MO); Río Tucurinca, foothills of Sierra Nevada, *Dugand 1025* (MO); San Pedro Alejandrino, *R. R. Castañeda 74* (F); Monteira, Zainum, *Molina & Barkley BO. 115* (MO, US), *Pennell 4140* (GH, MO, US).

SURINAM: Surinam River, *Focke 1287* (GH).

VENEZUELA. ARAGUA: Maracay, *Vogel 1455* (M). DISTRITO FEDERAL: Betel, *Clarendon 67* (US); around Caracas, *H. Pittier 9717* (G, US); Losa, *Tamayo 197* (MO). MERIDA: Tovar, *Fendler 2347* (G, GH, MO, P, US).

SECTION II. MACROVOLFIA (Pichon) A. S. Rao, emend.

§ *GRANDIFLORAE* Mgf. in Fedde, Rep. Spec. Nov. 20:116. 1924.
§ *HESPEROVOLFIA* Pichon, in Bull. Soc. Bot. Fr. 94:32, 33. 1947.

SERIES 3. LATIFOLIAE A. S. Rao, ser. nov.

Rami floriferi apice foliosi, cataphyllis super quoque nodo manifestis, hoc aucto nodo verticillato unico. Folia ca. bis longiora quam latiora (usque ter longiora in *R. polyphylla*) basi obtusa vel rotundata. Inflorescentiae terminales. Species typica: *R. polyphylla* Benth.

KEY TO THE SPECIES

A. Calyx-lobes ovate. Corolla-tube 6–8 mm. long.
  B. Leaves ovate or ovate-elliptic. Peduncles equal to or up to 4 times as long as the petioles.
    C. Leaves membranaceous or subcoriaceous, 1.5–2.5 cm. broad, petioles 1.0–1.5 cm. long. Peduncles slender, 3–4 times as long as the petioles. Northeastern Brazil...9 *R. mattfeldiana*
    CC. Leaves delicately membranaceous or strikingly coriaceous, 3–6 cm. broad, petioles 2.0–3.5 cm. long. Peduncles stout, as long as the petioles or up to 2.5 times as long.
      D. Leaves strikingly coriaceous. Peduncles as long as, or 1.5 times longer than, the petioles, pedicels 0.8–1.0 cm. long. Corolla-tube lilac-colored, 1.5–2 times as long as the corolla-lobes. Venezuela.....10. *R. pachyphylla*
      DD. Leaves delicately membranaceous. Peduncles 2.0–2.5 times as long as the petioles, pedicels 0.3–0.5 cm. long. Corolla-tube yellow, as long as or 1.25 times longer than the corolla-lobes. Colombia.....11. *R. leptophylla*
  BB. Leaves lanceolate. Peduncles shorter than the petioles. Northwestern Brazil. .....12. *R. polyphylla*
AA. Calyx-lobes lanceolate or deltoid. Corolla-tube 10–24 mm. long.
    E. Leaves with 5–11 pairs of distinctly arcuate secondary veins 8–12 mm. apart,
      F. Petioles 1.5–2.0 cm. long. Inflorescences 20-to many-flowered. Calyx-lobes deltoid, 1.0–1.5 mm. long.
        G. Leaves mostly 4 at node, membranaceous. Anthers 2.0–2.5 mm. long; ovary sulcately marked. Fruit bilobed, reniform. Northwestern Brazil and Peru.....13. *R. sprucei*
        GG. Leaves mostly 5 at node, subcoriaceous. Anthers 1.0–1.5 mm. long; ovary smooth. Fruit globose. Northwestern Brazil.....14. *R. paraensis*
      FF. Petioles 0.5–1.0 cm. long. Inflorescences 1- to 5-flowered. Calyx-lobes lanceolate, 2.5–3.5 mm. long. Northwestern Brazil and Peru.....15. *R. macrantha*
    EE. Leaves with 12–20 pairs of scarcely arcuate or almost transverse secondary veins 4–7 mm. apart. Northwestern Brazil.....16. *R. pentaphylla*

9. RAUVOLFIA MATTFELDIANA Mgf. in Fedde, Rep. Spec. Nov. 20:117, 120. 1924. (T.: *Ule 7114*!)

Shrubs 2–5 m. tall; branches 2-, 3- or 4-chotomous, terete to slightly 4-angled, sparsely lenticellate, glabrous, the base of young branches with caducous cataphylls 2–3 mm. long, about 1 mm. broad, the nodes with pectinate glands confined to the axil. LEAVES in verticils of 4 or 5 at the tips of twigs, slightly anisophyllous, short-petiolate, ovate-elliptic, acute to acuminate, attenuate at the base, the largest leaves 4–7 cm. long, 1.5–2.5 cm. broad, the smallest 2–4 cm. long, 1.0–1.5 cm. broad, membranaceous to subcoriaceous, glabrous, secondary veins and the vein network obscure above but distinct beneath; petioles slender, 1.0–1.5 cm. long. INFLORESCENCES terminal, lax, comparatively few-flowered, corymbose; peduncles slender, 2–4 cm. long, usually geminate, 2- to 3-branched, minutely bracteate, the bracts subulate, about 2 mm. long, the pedicels slender, 10–15 mm. long, glabrous. FLOWERS rather small; calyx deeply 5-lobed, the lobes ovate, acute, 1.5–2.0 mm. long, glabrous; corolla tubular, slender, 6–7 mm. long, glabrous without and pilose within along the upper half, the throat not constricted, the lobes linear-ovate, obtuse, 3–4 mm. long, 1.5–2.5 mm. broad; stamens 5, included, inserted near the throat, the anthers ovate, apiculate, 1.5–2.0 long, with a callosity on the back at the point of insertion, the filament obscure; ovary 2-carpellary, hemisyncarpous, obovoid, about 2.5 mm. high and 2 mm. in diameter, the ovules 1–2 in each locule on a ventral placenta, the disc annular, about 0.5 mm. broad, the style columnar, 3.0–3.5 mm. long, glabrous, the stigma-head cylindrical, a little narrowed in the

middle, obscurely bilobed. FRUITS deeply bilobed when young, 2-seeded.

In the fields near hilly areas; flowering in November. Northeastern Brazil.

The terminal verticils of rather small leaves with the distinct vein network beneath, the few-flowered, slender-peduncled inflorescences, the rather long pedicels of the fairly small tubular flowers, are characteristics which help in distinguishing this species from its related species.

BRAZIL. BAHIA: Bahia, Serra de Sincora, *Ule 7114* (G, L). MINAS GERAES: Minas Geraes, Tapanahoacanga, *Pohl 3462* (W).

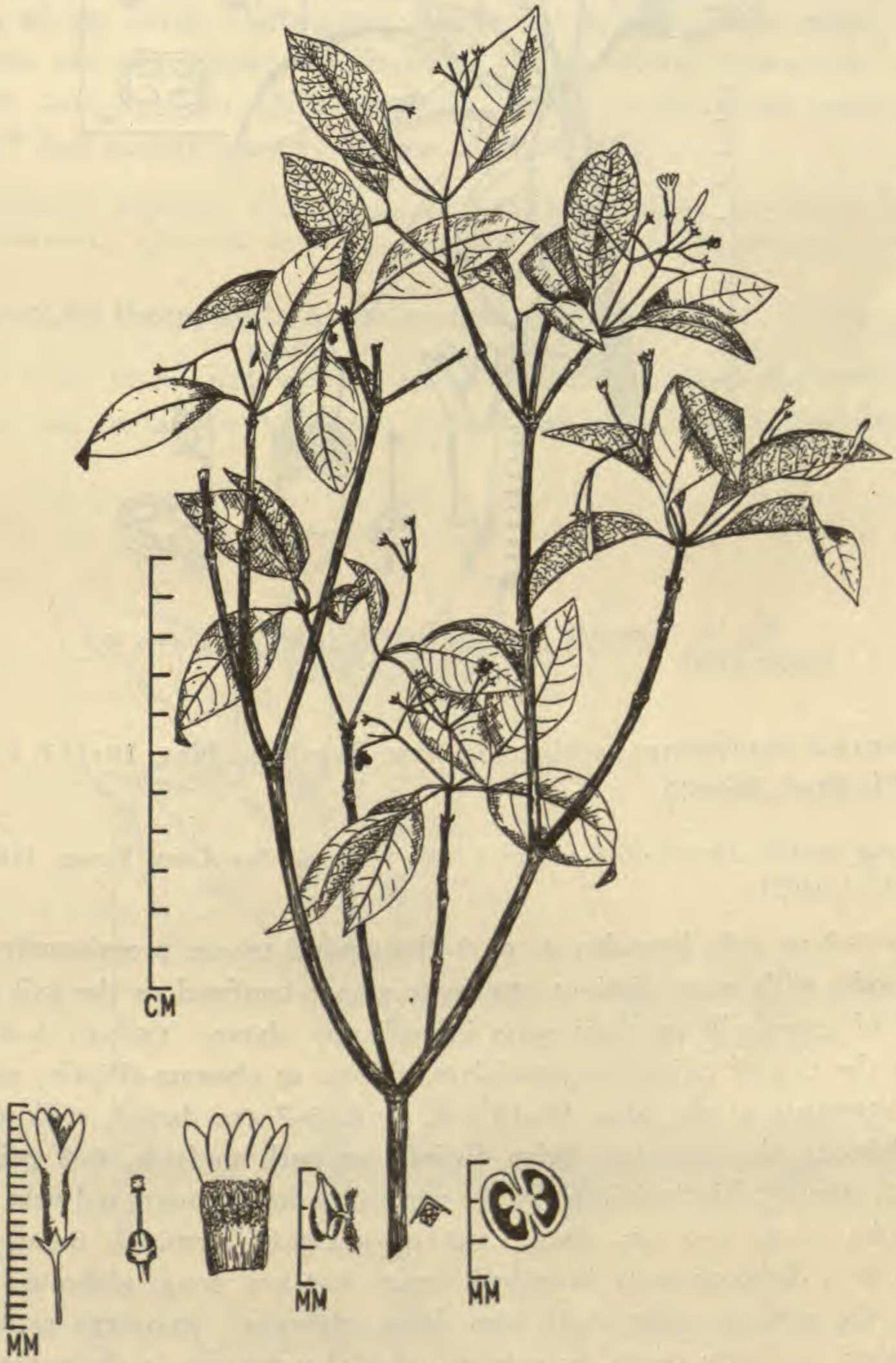

Fig. 9. *Rauvolfia mattfeldiana* Mgf. *(Ule 7114)*

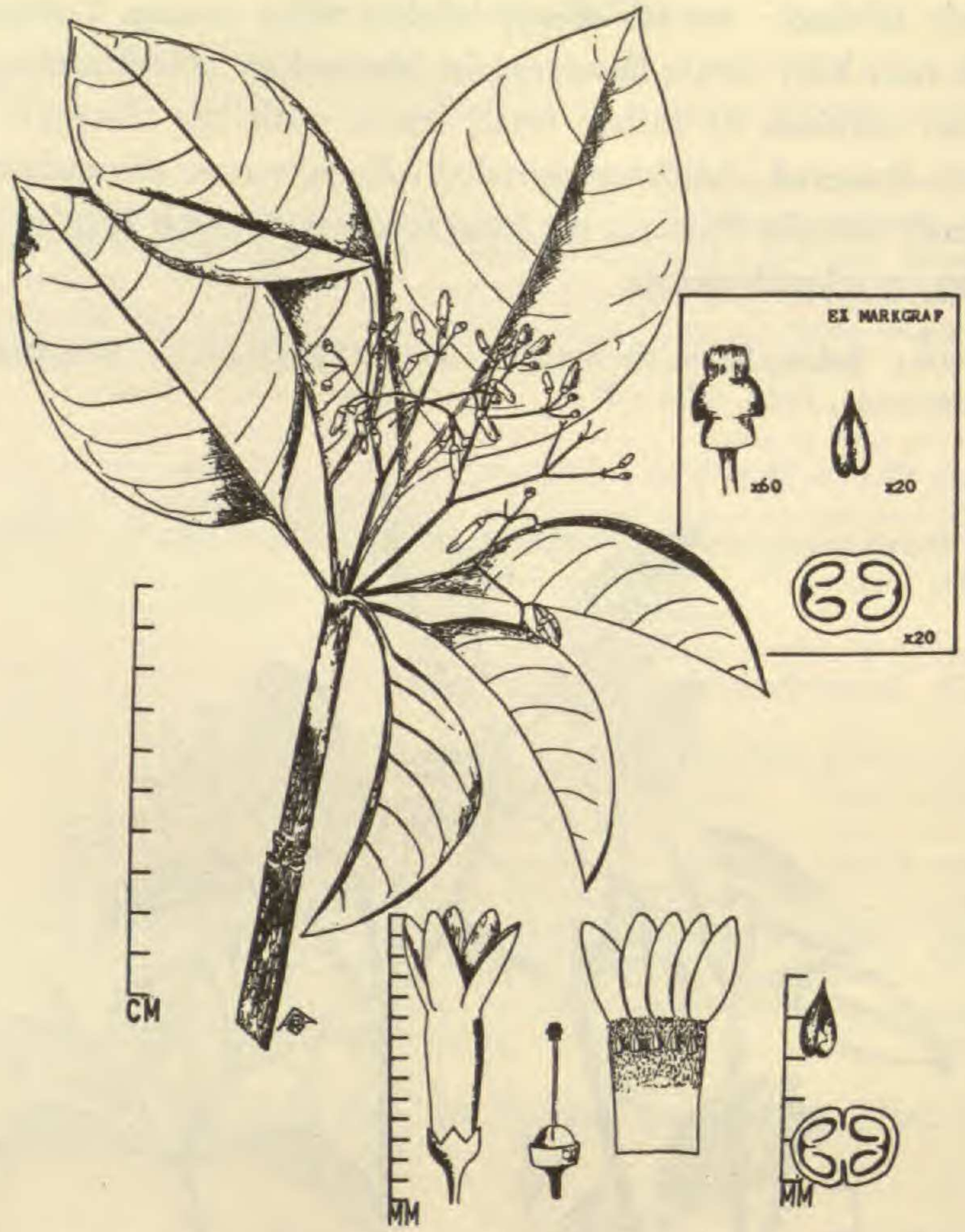

Fig. 10. *Rauvolfia pachyphylla* Mgf. *(Ule 8736* photo, and *Pittier 9465).*

10. RAUVOLFIA PACHYPHYLLA Mgf. in Fedde, Rep. Spec. Nov. 20:117, 121. 1924. (T.: *Ule 8736, photo*!)

Aspidosperma quadriovulatum Pitt. in Bol. Cient. y Tecn. Mus. Com. Venez. 1:66. 1925. (T.: *Pittier 9465*!)

Shrubs 1–2 m. tall; branches 2- or 3-chotomous, terete, prominently lenticellate, the nodes with many distinct, pectinate glands confined to the axil and with a verticil of cataphylls or their scars immediately above. LEAVES 4–6 at node usually at the tips of twigs, long-petiolate, elliptic to obovate-elliptic, acuminate, abruptly attenuate at the base, 10–15 cm. long, 5–7 cm. broad, strikingly coriaceous, glabrous, the secondary veins distinct on both surfaces, 6–8 pairs 10–15 mm. apart, arcuate, faintly joining at the margin to form a marginal vein on either side; petioles stout, 2–3 cm. long. INFLORESCENCES terminal, many-flowered; peduncles 2–3, dichotomously branched, stout, 3–4 cm. long, glabrous, minutely bracteate, the pedicels stout, 8–10 mm. long, glabrous. FLOWERS rather small; calyx 5-lobed, the lobes ovate, acuminate, glandular-dentate at the margin, about 1.5 mm. long, 1 mm. broad, the corolla tubular, lilac to dark violet in color

(Ule), about 7 mm. long, 2 mm. in diameter, glabrous without, pilose within near the throat, the throat a little constricted, the lobes ovate, obtuse, about 4 mm. long, 3 mm. broad; stamens 5, included, inserted near the throat, the anthers ovate, acuminate, about 1 mm. long, the filament obscure; ovary 2-carpellary, syncarpous, with 2 ovules in each locule on an axile placenta, the disc annular, the style columnar, the stigma-head cylindrical, constricted at the two ends, biapiculate.

Between rocks, amongst undershrubs, 900 to 1,600 m. altitude. Flowering May, June. Venezuela and Mount Roraima in British Guiana.

The type specimen of *R. pachyphylla* is presumably lost in the general destruction of the Berlin Herbarium. However, the type photo which I had for comparison includes Markgraf's drawings of the flower dissections. This was helpful in tracking down the identity of Pittier's *Aspidosperma quadriovulatum*. Woodson[49] had already determined this as a *Rauvolfia*.

VENEZUELA. BOLIVAR: Ptari-Tepui, southeast-facing slopes, *Steyermark 60022* (F). DISTRITO FEDERAL: quebrada de San Lázaro, near Caracas, *H. Pittier 9465, 11062* (US).

11. RAUVOLFIA **leptophylla** A. S. Rao, spec. nov.

Arbor circa 15 m. alta; ramulis sparse lenticellatis griseis plus minusve quadrangulatis basi ramulorum novorum caducis ibique cataphyllis praeditis. FOLIA

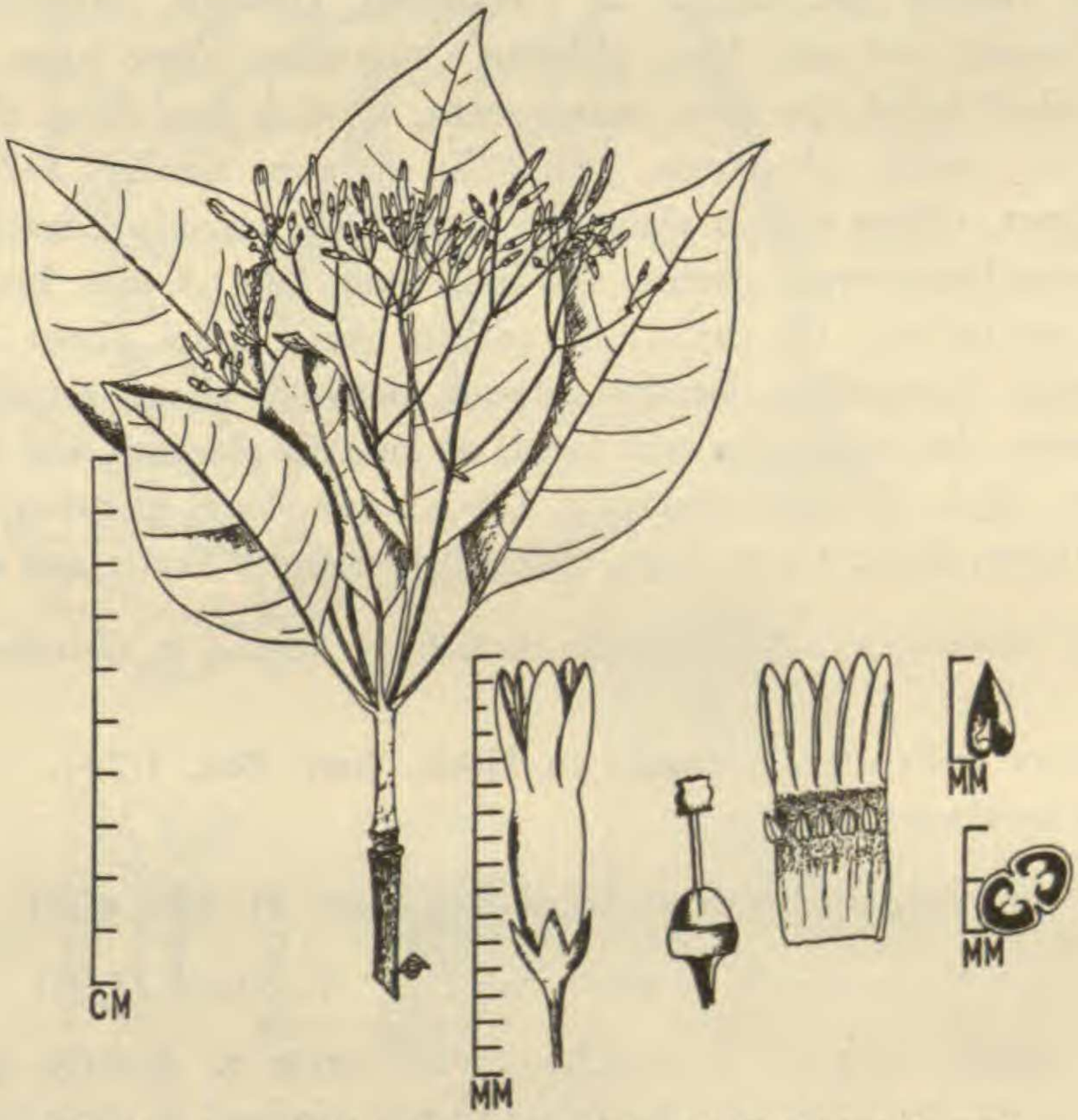

Fig. 11. *Rauvolfia leptophylla* A. S. Rao *(R. R. Castañeda 309)*

[49] Woodson, R. E., in Ann. Mo. Bot. Gard. 38:129. 1951.

tenuissima in apices ramulorum 5-verticillata glabra late elliptica inaequalia, majoribus 9–12 cm. longis 4–5 cm. latis, minoribus 5–6 cm. longis 3.0–3.5 cm. latis, nervis 9–15 in utroque latere arcuatis; petiolo 2.0–3.5 cm. longo eglandulo. INFLORESCENTIAE terminales corymbosae multiflorae, pedunculis binis 5–6 cm. longis glabris, pedicellis 3–5 mm. longis gracilibus. FLORES majusculi; calycis lobis 1.5–2.0 mm. longis circa 1 mm. latis glabris; corollae tubo flavido 6–7 mm. longo extus glabro intus in dimidio superiore praesertim supra insertionem staminum piloso, lobis lineari-ovatis obtusis, 4–5 mm. longis 1.0–1.5 mm. latis; staminibus 5 inclusis sub faucibus insertis, antheris ovatis acutis circa 1 mm. longis subsessilibus; ovariis bicarpellatis semiconnatis obovoides circa 2.5 mm. altis 2.0 mm. diametro 4-ovulatis; disco annulare circa 0.5 mm. alto, stylo 3.0–3.5 mm. longo, clavunculo calyptriformi circa 1 mm. alto, obtuse bilobato. FRUCTUS desunt.

Trees about 15 m. tall; branches terete or faintly 4-angular, sparsely lenticellate, glabrous, the base of young branches with caducous cataphylls, the nodes with pectinate glands confined to the leaf axils. LEAVES in verticils of 5 at the tips of twigs, slightly anisophyllous, long-petiolate, elliptic, acuminate, attenuate at the base, the largest leaves at the node 9–12 cm. long, 4–5 cm. broad, the smallest 5–6 cm. long, 3.0–3.5 cm. broad, delicately membranaceous, glabrous, secondary veins 9–15 pairs, arcuate, equally obscure on both surfaces; petiole stout, 2.0–3.5 cm. long. INFLORESCENCES terminal, many-flowered, corymbose; peduncles slender, 5–6 cm. long, usually geminate, 2- or 3-branched, glabrous, minutely bracteate, the pedicels slender, 3–5 mm. long, glabrous. FLOWERS rather large, calyx campanulate, deeply 5-lobed, the lobes ovate, acute, 1.5–2.0 mm. long, about 1 mm. broad, glabrous; corolla salverform, yellowish, the tube slender, 6–7 mm. long, glabrous without, villous within along the upper half, scarcely constricted at the throat, the lobes linear-ovate, obtuse, 4–5 mm. long, 1.0–1.5 mm. broad; stamens 5, included, inserted near the throat, the anthers ovate, acute, about 1 mm. long, subsessile; ovary 2-carpellary, hemisyncarpous, obovoid, about 2.5 mm. high, 2 mm. in diameter, the ovules 2 in each locule on an axile placenta, the disc annular, about 0.5 mm. high, the style columnar, 3.0–3.5 mm. long, glabrous, the stigma-head calyptriform, about 1 mm. high, obscurely bilobed. Fruits not seen.

COLOMBIA. MAGDALENA: San Sebastián de Rábago, *Romero R. Castañeda 900*, TYPE (MO).

12. RAUVOLFIA POLYPHYLLA Benth. in Hook. Jour. Bot. 3:241. 1841. (T.: *Robert Schomburgk 891*!)

R. polyphylla var. *connivens* Benth. ex Muell.-Arg. Mart. Fl. Bras. 6^1:31. 1860. (T.: *Spruce 1896*!)
R. polyphylla var. *divergens* Benth. ex Muell.-Arg. l. c. (T.: *Spruce 1837*!)

Trees or shrubs with di- or tri-chotomous, terete to slightly quadrangular, glabrous branches, the nodes with pectinate glands confined to the axil. LEAVES in verticels of 4–5 at the tips of twigs, slightly anisophyllous, long-petiolate, ovate-lanceolate, acute to acuminate at the tip, obtuse to abruptly attenuate at the base,

the largest leaves 11–15 cm. long, 3–5 cm. broad, the smallest 4–6 cm. long, 1–3 cm. broad, membranaceous, glabrous, secondary veins 5–10 pairs, arcuate, equally evident on both surfaces; petioles fairly slender, 1–3 cm. long. INFLORESCENCES terminal, few-flowered, corymbose; peduncles slender, 10–15 mm. long, glabrous, bracteate, the bracts linear-lanceolate, about 1.5 mm. long, the pedicels slender, 2–5 mm. long, glabrous. FLOWERS white, odorous; calyx deeply 5-lobed, the lobes

Fig. 12. *Rauvolfia polyphylla* Benth. *(R. Spruce 3821,* and *1896)*

ovate, acute to acuminate, 1.5–2.0 mm. long, 1.0–1.5 mm. broad, glabrous; corolla tubular, white, a little dilated near the throat, 6–8 mm. long, glabrous without, villous within along the upper half, rather densely near the anther tips, the lobes linear-ovate, obtuse, 4–5 mm. long, 2.0–2.5 mm. broad; stamens 5, included, inserted near the throat, the anthers ovate, acute to acuminate, 1.0–1.5 mm. long, with a dorsal callosity at the point of insertion, the filament about 0.5 mm. long; ovary 2-carpellary, fused at the very base, obovoid, about 2.5 mm. high, 2 mm. in diameter, the ovule 1 in each locule on a ventral placenta, the disc annular, about 1 mm. broad, the style linear, 3.0–3.5 mm. long, glabrous, the stigma-head cylindrical, constricted at the two ends, about 1 mm. high, obscurely bilobed. FRUITS deeply bilobed, compressed, pear-shaped, 15–19 mm. long, 14–15 mm. broad, glabrous.

Chiefly near dry river beds and on the banks of streams; flowering from September to November and fruiting in December. Northern Brazil and Guiana border.

This species can easily be recognized by its ovate-lanceolate leaves and the peduncles much shorter than the petioles.

The two varieties, obviously based on the characters of the leaves and the fruits, do not deserve to be maintained, as both the characters are variable and are of no taxonomic significance.

BRAZIL. AMAZONAS: Mañaos, Río Taruma, Igapo ad ripas infra cataractum minorum, *Ducke 626* (F, MO, RB, US); Cucuhy, Río Negro, Igarape Macacumy, *Ducke s. n., RB 30117* (RB); secus Río Negro, inter Barcellos et San Gabriel, *Spruce 1896* (P, W); inter Barra et Barcellos, *Spruce 1837* (G, GH, MO, W); ad flumen Guainia et Río Negro supra ostium flumini Cusquiari, *Spruce 3821* (P, W); Brasilia australis, without precise locality, *Riedel s. n.* (G, P).

GUIANA: *Robert Schomburgk 891* (W).

13. RAUVOLFIA SPRUCEI Muell.-Arg. in Mart. Fl. Bras. 6^1:34. 1860. (T.: *Spruce 1732!*)

R. lauretiana Woodson, in Ann. Mo. Bot. Gard. 18:541. 1931. (T.: *G. Klug 35!*)

Trees 8–25 m. tall; branches terete, sparsely lenticellate, bark dark brown, crackled or longitudinally striated, the nodes with glands confined to the axil. LEAVES in whorls of 4, rarely 3 or 5, at the tips of twigs, slightly anisophyllous, long-petiolate, ovate to rhombic-ovate, acute to acuminate, abruptly attenuate at the base, the largest leaves 9–15 cm. long, 5–8 cm. broad, the smallest leaves 5–8 cm. long, 3–5 cm. broad, membranaceous, glabrous, the secondary veins 7–10 pairs, arcuate, rather obscure above, very distinct beneath; petioles stout, 1.5–3.5 cm. long. INFLORESCENCES terminal, many-flowered; peduncles 1–4 cm. long, dichotomously branched, the secondary peduncles often longer than the primary peduncle, glabrous, bracteate, the bracts ovate, acuminate, about 1.5 mm. long, the pedicels slender, 5–12 mm. long, glabrous. FLOWERS conspicuous; calyx deeply 5-lobed, the lobes broadly deltoid, broadly acute to obtuse, 1.0–1.5 mm. long, about 2 mm. broad, the margin minutely ciliate, glabrous; corolla tubular, whitish with crimson

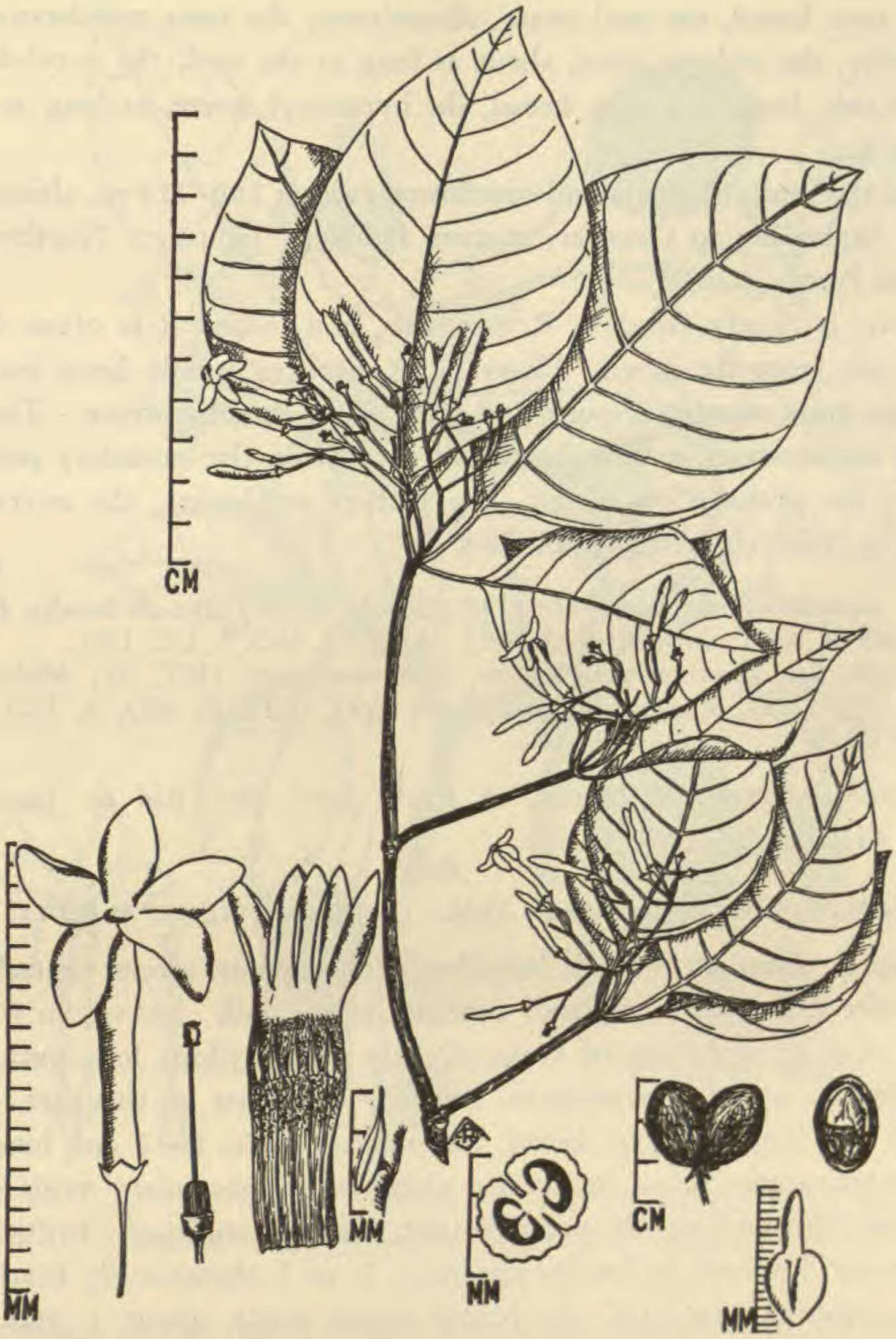

Fig. 13. *Rauvolfia sprucei* Muell.-Arg. *(Spruce 1732, Mexia 6415)*

streaks, 12–20 mm. long, about 2 mm. in diameter, glabrous without, sparsely pilose within near the throat, the throat scarcely dilated, the lobes obovate, obtuse, 5–8 mm. long, 3–5 mm. broad; stamens 5, included, inserted a little below the throat, the anthers ovate, acuminate, 2–3 mm. long, with a callosity on the back at the point of insertion, subsessile; ovary 2-carpellary, hemisyncarpous, cylindrical, about 3 mm. high, 2 mm. in diameter, sulcately marked, the ovules 2 in each locule on an axile placenta, the style filiform, 5–12 mm. long, glabrous, the stigma-head calyptriform, about 1.5 mm. high, biapiculate. FRUITS reniform, bilobed when both carpels develop, but often ovoid, with only one carpel developing, 20–25 mm. high, 14–16 mm. broad, the stones ovate, compressed, faintly rugose, 19–24 mm.

long, 9–15 mm. broad, the seed ovate, albuminous, the testa membranaceous, the albumen fleshy, the embryo erect, about as long as the seed, the cotyledons ovate, obtuse, 5–9 mm. long, 3–5 mm. broad, the hypocotyl terete, as long as the cotyledons, superior.

Trees on the banks of rivers and overflowed creeks; 100–110 m. altitude. Flowering from September to October; mature fruits in January. Northwest Brazil and northern Peru.

R. sprucei is closely allied to *R. paraensis*, and indeed it is often difficult to distinguish one from the other. However, *R. sprucei* usually bears leaves in 4's, the leaves are quite membranaceous, and more often rhombic-ovate. The peduncle is regularly dichotomous in branching, and very often the secondary peduncles are longer than the primary peduncle. The anthers are longer, the ovary sulcately marked. The fruits are reniform, bilobed.

BRAZIL. AMAZONAS: Barra, *Spruce 1732* (G, GH, K, W) Ilha de Bacaba, *Fröes 21307* (F, K); mouth of Rio Embira, *Krukoff 4683* (A, G, M, MO, S, UC, US).

PERU. LORETO: Maranon von Iquitos, *Tessmann 5107* (NY, S); Mishuyacu, near Iquitos, *Klug 35* (US), Rancho Indiana, *Mexia 6415* (GH, K, MO, S, US); Tarapoto, *Spruce 3856* (K, W).

14. RAUVOLFIA PARAENSIS Ducke, in Arch. Jard. Bot. Rio de Janeiro 4:167. 1925. (T.: *Ducke, RB 43*!)

R. amazonica Mgf. in Notizblatt 9:960. 1926. (T.: *Ducke, RB 917* & *RB 11, 395*!)

Trees up to about 20 m. tall; branches trichotomous, terete, sparsely lenticellate, the nodes with pectinate glands confined to the axil, LEAVES in whorls of 5, rarely 2, 3, 4, or 6, at the tips of twigs, slightly anisophyllous, long-petiolate, ovate to ovate-elliptic, acute to acuminate, abruptly attenuate at the base, the largest leaves 9–18 cm. long, 5–9 cm. broad, the smallest leaves 8–12 cm. long, 3–7 cm. broad, membranaceous to subcoriaceous, glabrous, the secondary veins 6–10 pairs, arcuate, more distinct beneath; petioles stout, 1.5–4.5 cm. long. INFLORESCENCES terminal, many-flowered; peduncles geminate, 2- or 3-chotomously branched, 2–18 cm. long, glabrous, bracteate, the bracts ovate, acute, about 1 mm. long, the pedicels slender, 5–10 mm. long, glabrous. FLOWERS conspicuous; calyx deeply 5-lobed, the lobes broadly deltoid, acute, about 1.5 mm. long, 2 mm. broad, glabrous; corolla tubular, white with scarlet streaks (according to Ducke), 12–20 mm. long, about 2 mm. in diameter, glabrous without, sparsely pilose within near the throat, the throat a little dilated, the lobes ovate, obtuse to rounded, 3–6 mm. long, 2–4 mm. broad; stamens 5, included, inserted near the throat, the anthers ovate, acute, 1.0–1.5 mm. long, with a callosity on the back at the point of insertion, subsessile; ovary 2-carpellary, hemisyncarpous, cylindrical, 2.5–3.5 mm. high, about 2 mm. in diameter, smooth, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. broad, the style filiform, 6–15 mm. long, glabrous, the stigma-head drum-shaped, about 1 mm. high, bilobed. FRUITS globose, 3–4 cm. in diameter, 2-seeded, one of them often abortive, the stones fusi-

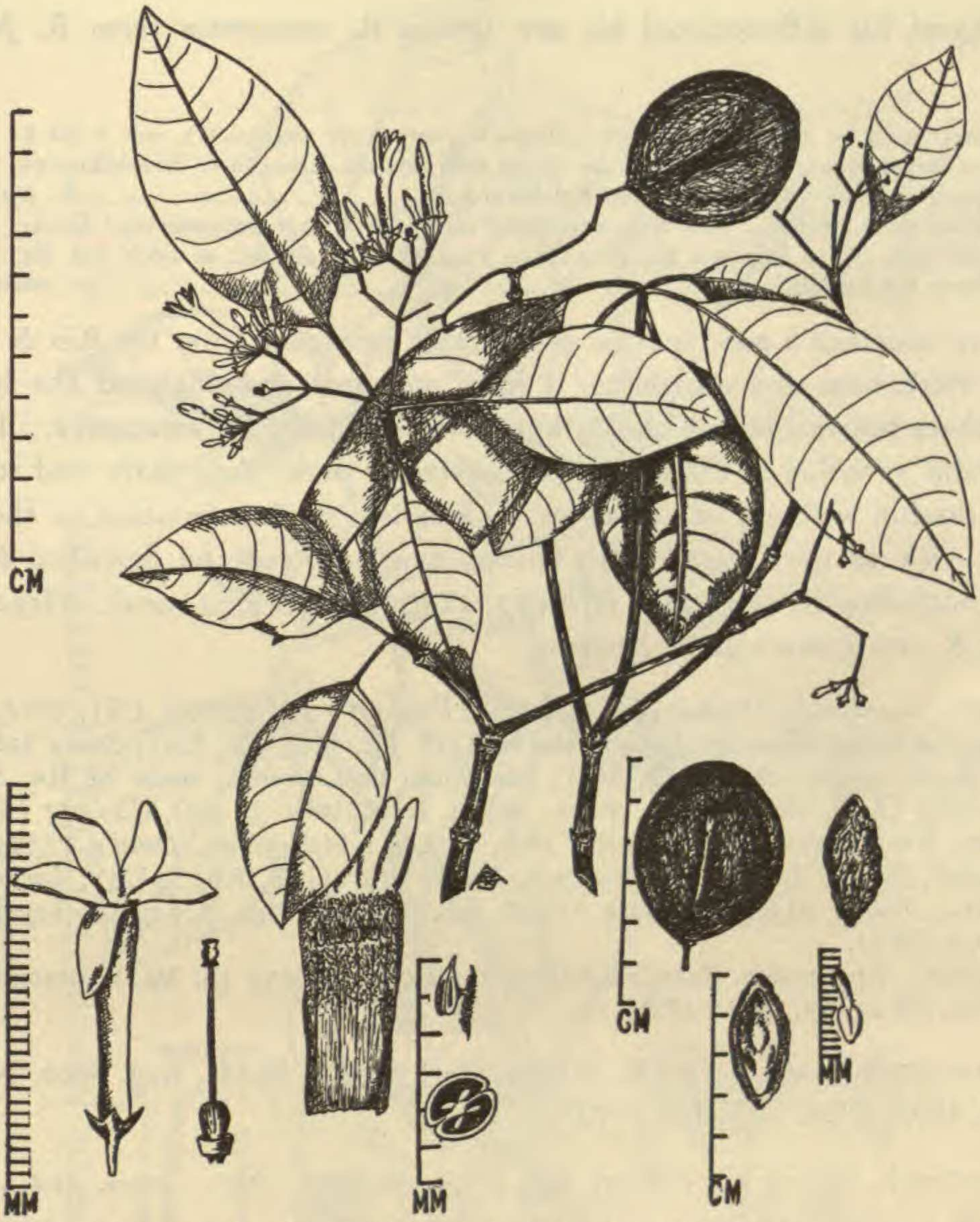

Fig. 14. *Rauvolfia paraensis* Ducke *(Ducke RB 43)*

form, compressed, rugose, 3.0–3.5 cm. long, about 1 cm. broad, the seed elliptic, albuminous, the testa membranaceous, the albumen carnose, the embryo about half as long as the seed, erect, the cotyledons ovate, obtuse, 4–5 mm. long, 2.0–2.5 mm. broad, the hypocotyl terete, equal in length to the cotyledons.

Trees in non-inundated primary forests; flowering from September to January, ripe fruits in May. Northern and northwestern Brazil.

COMMON NAME: Brazil, Pará—*Gogo de Guariba.*

This species is closely related to *R. sprucei* and *R. pentaphylla.* It differs from the former in having mostly elliptic, coriaceous leaves in 5's; the primary peduncles usually much longer than the secondary peduncles; the flowers with shorter anthers and smooth ovaries and the fruits globose. It differs from the latter species in having fewer distinctly arcuate secondary veins and slightly larger fruits.

Markgraf has differentiated his new species *R. amazonica* from *R. paraensis* thus:—

2. Blätter 3 zu bis 4, gröber, längliche-elliptisch (vorn kurz zugespitzt), mit 6 bis 8 Paar Seitennerven; Kronzipfel ⅓ bis ½ so lang wie die Kronröhre; Fruchtknoten doppelt so hoch wie die stumpfen Kelchzipfel.....*R. paraensis*
3. Blätter zu 3, eiförmig, vorn lang zugespitzt, mit 5 bis 8 Paar Seitennerven; Kronzipfel etwa ⅔ so lang wie die Kronröhre, Fruchtknoten doppelt so hoch wie die spitzen Kelchzipfel.....*R. amazonica*

I have examined a good number of Ducke's specimens from the Rio de Janeiro Garden Herbarium and elsewhere. I have measured and analyzed the leaf and flower characteristics on which Markgraf has based his *R. amazonica.* I find a considerable variation in the number of leaves per node, their shape and structure clearly varying with age of the twigs. There is a similar variation in the flower too. In view of this, I agree with Ducke, who collected and described *R. paraensis,* in including *R. amazonica (RB 917, 11395)* under that name. Hence, I am merging *R. amazonica* with *R. paraensis.*

BRAZIL. AMAZONAS: Borba (Rio Madeira), *Ducke 74* (A, F, MO, US), *30115* (RB); Esperança, ad ostium fluminis Jauary, *Ducke 1118* (K, MO, RB, US); Santa Izabel, Rio Negro, *Ducke 23950* (A, RB, S, US); São Paulo de Olivença, basin of Rio Solimoes, *Krukoff 8996* (A, F, MO, P, US). PARA: Belem, *Ducke 785* (F, MO, US), *43* (RB, US); Boa Vista, Rio Tapajos, *Ducke 11391* (RB, S, US); Macajubim, *Ducke 11395* (RB); Santa Izabel, Estrada de Ferro do Braganca, *Ducke 917* (G, P, RB, S, US); Juruty Velho (Civ. Para), *Ducke 2159F* (G, with 917, P, RB, S, US); Villa Nova, Rio Tapajos, *Pires 3577, 4021* (MO).

SURINAM. Brownsweg, *Zaandam 6885* (L), *Lanjouw 1255* (S, MO); precise locality not known, *RB 21835, 27412* (RB).

15. RAUVOLFIA MACRANTHA K. Sch. ex Markgraf, in Fedde, Rep. Spec. Nov. 20: 117, 120. 1924. (T.:*Ule 5174*!)

R. micrantha K. Sch. ex Ule in Engl. Bot. Jahrb. 40:136. 1907. *(nom. nud., sphalm).*

Shrubs up to 6 m. tall; branches 2-, 3-, or 4-chotomous, terete, glabrous, the bark longitudinally wrinkled, the nodes with axillary glands. LEAVES in whorls of 4, slightly anisophyllous, short-petiolate, ovate to broadly ovate-elliptic, acute to acuminate at the tip, abruptly attenuate at the base, the largest leaves 8–10 cm. long, 4–7 cm. broad, the smallest 3–6 cm. long, 2–4 cm. broad, membranaceous, the secondary veins 5–7 pairs, arcuate, distinct on both surfaces; petioles slender 0.5–1.0 (1.5) cm. long. INFLORESCENCES terminal, few-flowered; peduncles geminate, slender, 1–3 cm. long, bracteate, the bracts lanceolate, about 1.5 mm. long, the pedicels slender, 5–8 mm. long, glabrous. FLOWERS conspicuous; calyx deeply 5-lobed, the lobes lanceolate, acuminate, 2.5–3.5 mm. long, glabrous; corolla salverform, white (Ule), 15–20 mm. long, about 2 mm. in diameter, glabrous without, villous within for more than half of the upper part, a little dilated near the throat, the lobes ovate, broadly acute to obtuse, 5–6 mm. long, 3–4 mm. broad; stamens 5, inserted about 3 mm. below the throat, in the region of the dilatation, the anthers linear-ovate, acuminate, 2–3 mm. long, with a dorsal callosity,

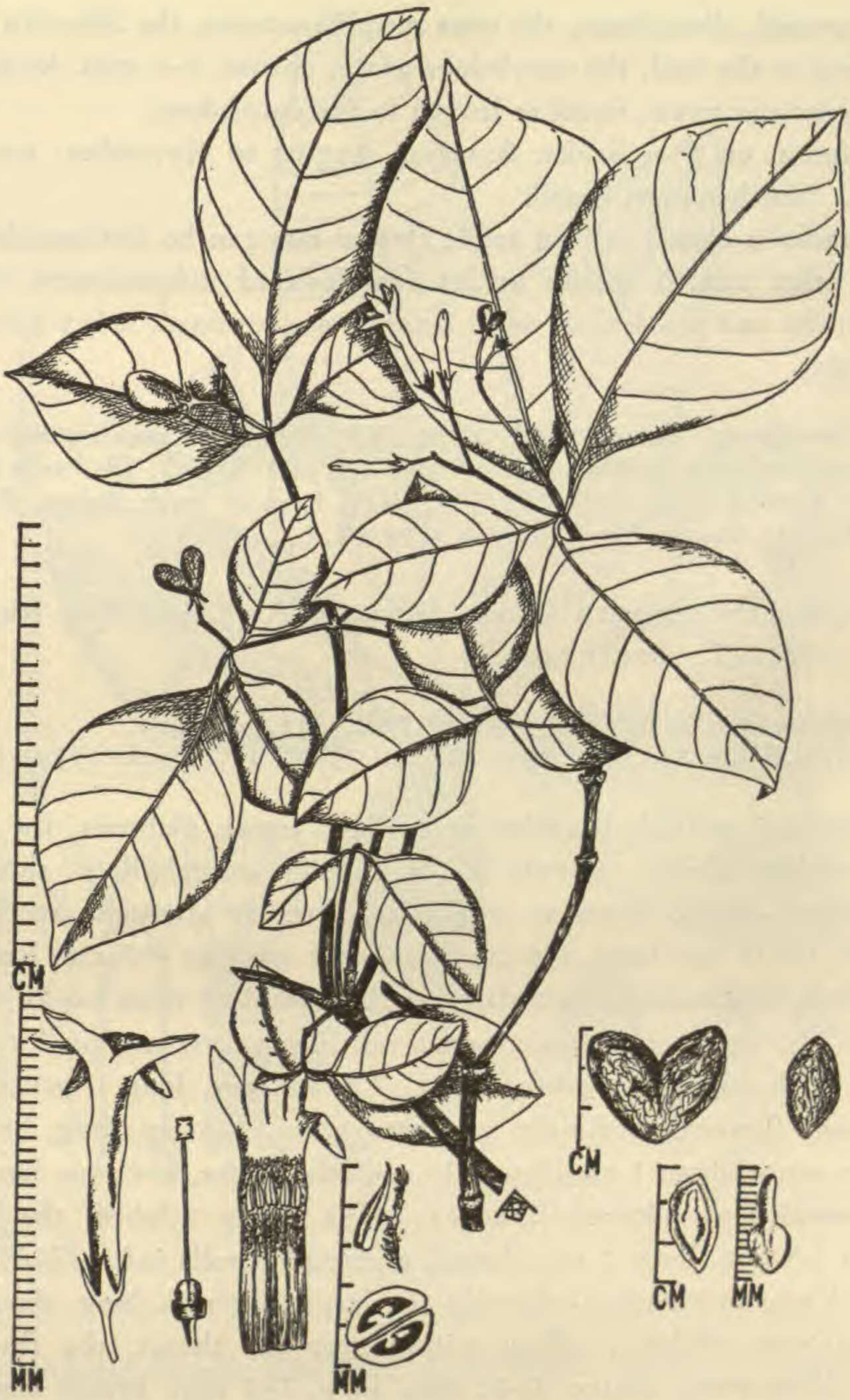

Fig. 15. *Rauvolfia macrantha (Ule 5174* and *Krukoff 6698)*

subsessile; ovary 2-carpellary, almost apocarpous, cylindrical, about 2.5 mm. high, 2 mm. in diameter, glabrous, the ovules 2 in each locule on a ventral placenta, the disc annular, about 1 mm. broad, the style linear, 10–12 mm. long, glabrous, the stigma-head cylindrical, narrowed at the two ends, about 1.5 mm. high, obscurely bilobed. FRUITS obcordate, deeply bilobed, often only one carpel developing, then ovoid, rounded, 2.5–3.5 cm. high, about 2.5 cm. broad, 2-seeded, the stones elliptic, a little flattened, faintly rugose, 2.0–2.5 cm. long, about 1 cm. broad, the seed

elliptic, compressed, albuminous, the testa membranaceous, the albumen fleshy, the embryo as long as the seed, the cotyledons ovate, obtuse, 5–6 mm. long, 3–4 mm. broad, the hypocotyl terete, equal in length to the cotyledons.

In high forest, on river banks; flowering August to November; mature fruits in December. Northwestern Brazil.

R. macrantha is closely related to *R. sprucei* but can be distinguished from it and all the other related species by its few-flowered inflorescences with short, slender peduncles and the flowers with lanceolate, acuminate calyx-lobes, and the obcordate fruits.

BRAZIL. AMAZONAS: Japura, *Ducke 6772* (RB); Humayta municipality near Livramento, on immediate shore of river, *Krukoff 6698* (A, MO, S, US); São Paulo de Olivença, near Palmares, *Krukoff 8262, 8422* (A, F, G, MO); basin of creek, Belem, *Krukoff 8871* (A, F, G, MO, US); Marary, Rio Juruá, *Ule 5174* (G, L).

16. RAUVOLFIA PENTAPHYLLA (Hub.) Ducke, in Arch. Jard. Bot. Rio de Janeiro 3:244. 1922. (T.: *Ducke 11038*!)

Couma pentaphylla Hub. in Bol. Mus. Goeldi 7:124. 1913, *nom. nud.*
R. duckei Mgf. in Fedde, Rep. Spec. Nov. 20:121. 1924. (T.: *Ducke 16544*!)

Trees about 25 m. tall; branches verticillate, terete, glabrous, the nodes with prominent axillary glands. LEAVES in 5's, slightly anisophyllous, short-petiolate, ovate to obovate-elliptic, acute to acuminate, abruptly attenuate at the base, the largest leaves 10–15 cm. long, 4–6 cm. broad, the smallest 4–7 cm. long, 2–3 cm. broad, firmly membranaceous to coriaceous, the secondary veins 12–20 pairs, transverse, very little curved at the margins and uniting to form marginal veins, equally distinct on both surfaces; petioles stout, 1.5–3.0 cm. long. INFLORESCENCES terminal, many-flowered; peduncles geminate, stout, 3–6 cm. long, bracteate, the bracts ovate, acute, about 1 mm. long, the pedicels slender, 2–6 mm. long, glabrous. FLOWERS conspicuous, odorous (Ducke); calyx deeply 5-lobed, the lobes ovate, acute, about 1.5 mm. long, 2 mm. broad, glabrous; corolla infundibuliform, white with purplish streaks (Ducke), the tube slender, 12–18 mm. long, about 2 mm. in diameter, glabrous without, villous within near the throat, the throat a little dilated, the lobes ovate, obtuse, 6–12 mm. long, 3–5 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, 1.0–1.5 mm. long, with a dorsal callosity, subsessile; ovary 2-carpellary, hemisyncarpous, cylindrical, about 2.5 mm. high, 2 mm. in diameter, glabrous, the ovule 1 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style columnar, 10–15 mm. long, glabrous, the stigma-head cylindrical, bulged in the middle, obscurely bilobed. FRUITS subglobose to globose, 2.5–3.0 cm. in diameter, 2-seeded, the stones elliptic, 2.0–2.5 cm. long, about 1 cm. broad, faintly rugose, the seed slightly compressed, albuminous, the testa membranaceous, the albumen carnose, the embryo erect, the cotyledons elliptic, 4–5 mm. long, 2.5–3.0 mm. broad, the hypocotyl terete, equal in length to the cotyledons.

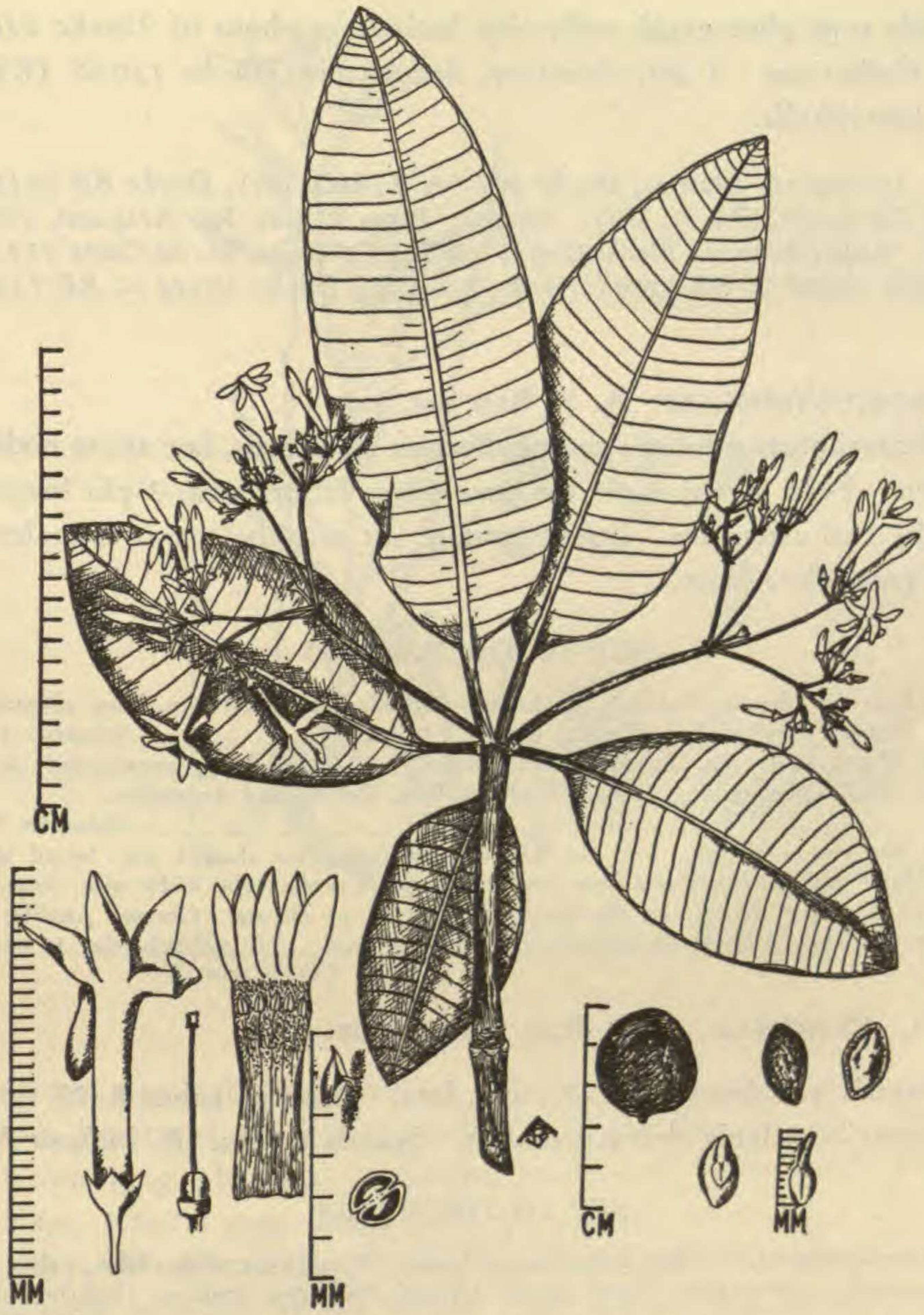

Fig. 16. *Rauvolfia pentaphylla* Ducke *(Ducke 11038)*

In non-inundated forests; flowering from June to December; mature fruits in March, April. Northern Brazil.

COMMON NAMES: Brazil, Amazonas—*Itapeua Grande, Marfim,* and *Muira Jussara.* Ducke has pointed out that the last name is also used for *Aspidosperma duckei,* which is a tree resembling *R. pentaphylla.*

This species very much resembles *R. paraensis,* but can be distinguished by its leaves with numerous, quite transverse secondary veins, and the smaller fruits. As in *R. paraensis,* here also there is considerable variation in the leaf and flower characteristics. Hence, there is no reason for the continued distinction of *R. duckei.* Ducke has cited several numbers in his original description. Of these I have not seen *11032,* but *11038* I find well represented in the several herbaria.

The Macbride type photograph collection includes a photo of *Ducke 11038* from the Berlin Herbarium. I am, therefore, designating *Ducke 11038* (RB) as the type of *R. pentaphylla*.

BRAZIL. AMAZONAS: Mañaos, *Ducke 492* (A, F, MO, US), *Ducke RB 22426* (P, RB, US), *Ducke RB 23941* (RB, S, US). AMAPÁ: Porto Platon, Rio Araguari, *Pires & Silva 4784* (MO). PARÁ: Belterra, *Black 47–942* (NY); Cajutuba, M. *da Costa 273* (F, MO); Gurupa, *Ducke 11038* = *RB 13298* (G, P, RB, US), *Ducke 16544* = *RB 13299* (G, P, RB, US).

SERIES 4. **ANGUSTIFOLIAE** A. S. Rao, ser. nov.

Rami floriferi prorsus foliosi, cataphyllis non manifestis, hoc aucto nodis verticillatis pluribus. Folia 3- vel 4-plo longiora quam latiora (ca. 2-plo longiora in *R. steyermarkii*) basi attenuata. Inflorescentiae aut terminales aut laterales. Species typica: *R. grandiflora* Mart.

KEY TO THE SUBSERIES

A. Leaves linear or obovate, 0.2–2.5 cm. broad. Corolla-tube 8–20 mm. long, constricted at the throat; corolla-lobes obovate, obtuse. Cuba.....Subseries 1. CUBANAE
AA. Leaves elliptic, 3–5 cm. broad. Corolla-tube 5–12 mm. long, constricted at the throat; corolla-lobes oblong, acute. Andes of Peru, Bolivia and Argentina.
.....Subseries 2. ANDINAE
AAA. Leaves obovate or elliptic, 3–7 cm. broad (sometimes less than 3 cm. broad in *R. weddelliana* and *R. paucifolia*, but not obovate). Corolla-tube 4–20 mm. long, not constricted at the throat; corolla-lobes ovate, acute or obtuse. Greater Antilles and northern regions of South America.....Subseries 3. GRANDIFLORAE

SUBSERIES 1. **CUBANAE** A. S. Rao, subser. nov.

Folia linearia vel obovata 0.2–2.5 cm. lata. Corollae tubus 8–20 mm. longus, faucibus constrictis; lobis obovatis obtusis. Species typica: *R. cubana* A. DC.

KEY TO THE SPECIES

A. Herbaceous subshrubs 1–5 dm. tall. Leaves linear. Corolla purplish-violet; calyx-lobes membranaceous, acuminate. Fruits deeply 2-lobed, the lobes acute or slightly beaked. Oriente.....17. *R. linearifolia*
AA. Woody shrubs 2–8 m. tall. Leaves obovate. Corolla white; calyx-lobes coriaceous, obtuse. Fruits bilobed at the top, the lobes obtuse or broadly acute, but not beaked.
B. Leaves mostly 4-nate. Corolla-tube 8–10 mm. long, glabrous in the throat, the lobes half as long as the tube. Oriente.....18. *R. salicifolia*
BB. Leaves mostly 3-nate. Corolla-tube 12–20 mm. long, villous in the throat, the lobes almost as long as the tube. Western provinces of Cuba and the Isle of Pines...19. *R. cubana*

17. RAUVOLFIA LINEARIFOLIA Brit. & Wils., in Mem. Torr. Bot. Club 16:94. 1920. (T.:*Shafer 1754*!)

Shrubs 1–5 dm. tall; branches slender, terete, 2-chotomously branching, glabrous, the nodes with minute glands confined to the leaf-axils. LEAVES in whorls of 3, scarcely anisophyllous, shortly petiolate, linear, acute to acuminate, attenuate, at base, 2–6 cm. long, 0.2–0.5 cm. broad, membranaceous, the midrib distinct on both surfaces but the secondary veins obscure; petioles slender, 1–3 mm. long.

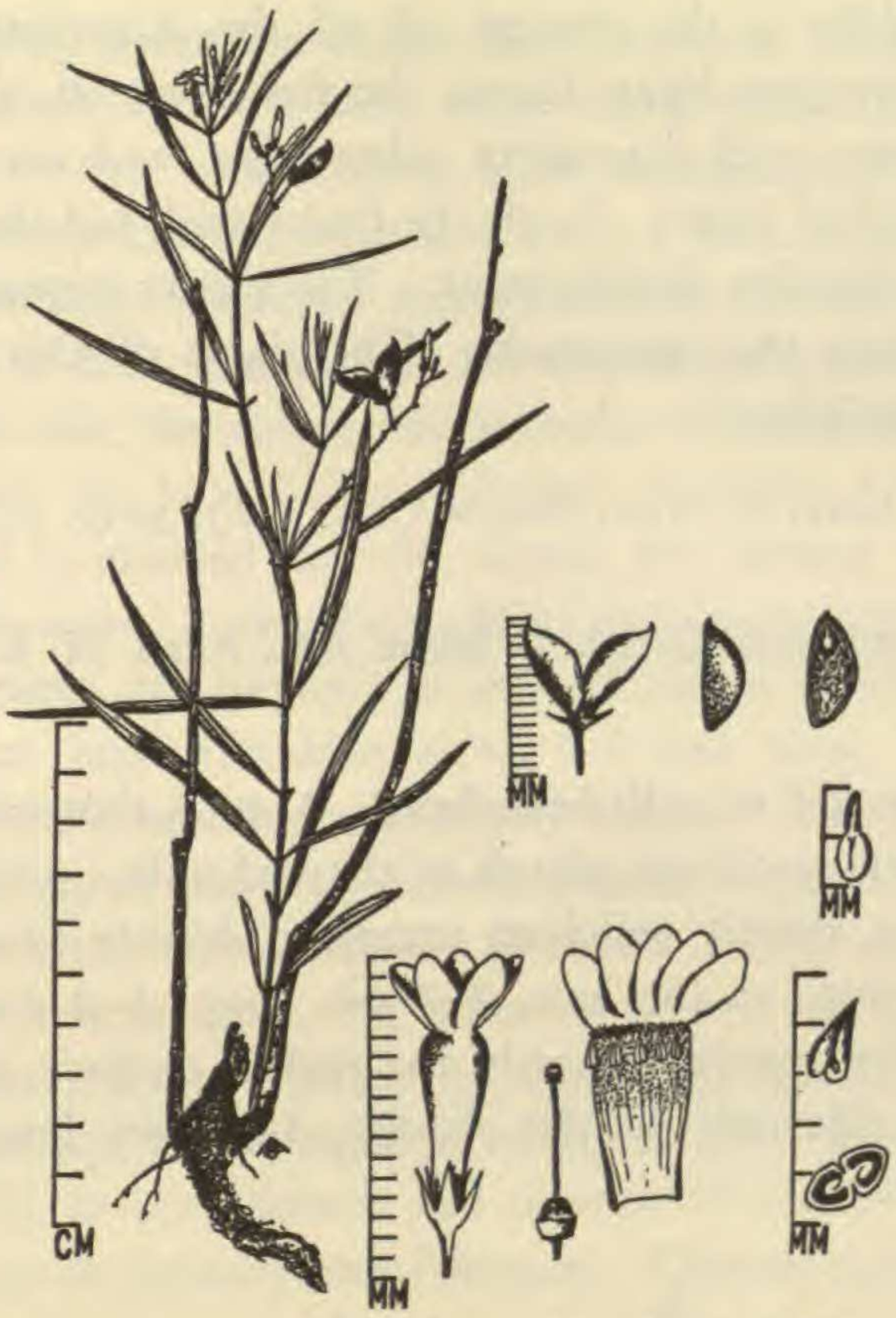

Fig. 17. *Rauvolfia linearifolia* Brit. & Wils. *(Ekman 9552).*

INFLORESCENCES terminal, few-flowered, cincinnate; peduncles slender, 1–3 cm. long, glabrous, bracteate, the bracts lanceolate, about 1.5 mm. long, the pedicels slender, 2–5 mm. long, glabrous. FLOWERS conspicuous; calyx deeply 5-lobed, the lobes lanceolate, 1.5–2.0 mm. long, glabrous; corolla salverform, pale purplish-violet (Ekman), the tube slender, 8–10 mm. long, about 1.5 mm. in diameter at the base, glabrous without, villous within along the top half, constricted at the throat, the lobes ovate-elliptic, obtuse to rounded, 4–5 mm. long, 1.5–2.5 mm. broad; stamens 5, inserted near the throat, the anthers linear-ovate, about 1.5 mm. long, the filament about 0.5 mm. long; ovary 2-carpellary, connate at the base, obovoid, about 1.5 mm. high and 1.5 mm. in diameter, the ovule 1 in each locule on a ventral placenta, the disc annular, about 1 mm. high, the style linear, 5–6 mm. long, glabrous, the stigma-head drum-shaped, about 1 mm. high, obtusely bilobed. FRUITS deeply bilobed, the lobes widely divergent, flattened, semi-lunate, acuminate or slightly beaked, 9–12 mm. long, 2.5–3.0 mm. broad, the stones elliptic, smooth, the seed elliptic, flattened, albuminous, the testa membranaceous, the embryo erect, small (probably abortive), the cotyledons elliptic, rounded, about 1 mm. long, 0.5 mm. broad, the hypocotyl terete, equal in length to the cotyledons.

On limestone hills and in the savannas; flowering from April to September; ripe fruits in October and November. Oriente Province in Cuba.

Rauvolfia linearifolia is the shortest of all the American Rauvolfias. It is characterized by its narrow, linear leaves, the few-flowered, slender-peduncled inflorescences, the flowers with lanceolate calyx-lobes, and the compressed, widely divergent, slightly beaked fruits. In all the fruits analyzed the embryos were very small and indicated abortive development. The plants appear to propagate more often vegetatively from the root-stocks. The plants of this species are endemic, and apparently rare in Cuba.

CUBA. ORIENTE: Sierra de Nipe, *Ekman 1733, 5913, 5939, 9552, 9685, 15304* (S); *Shafer 1754* (NY).

18. RAUVOLFIA SALICIFOLIA Griseb. in Mem. Am. Acad. N. S. 8:519. 1863. (T.: *Wright 1386*!)

Shrubs or trees up to 8 m. tall; branches 2-, 3- or 4-chotomous, terete, glabrous, the nodes with distinct pectinate glands in the leaf-axils. LEAVES in whorls of 4, scarcely anisophyllous, shortly petiolate, narrowly obovate to oblanceolate, broadly acute to obtuse, cuneate at the base, 2–7 cm. long, 1–2 cm. broad, coriaceous, slightly lustrous above, opaque beneath, the midrib distinct on both surfaces but the secondary veins obscure; petioles slender, 3–8 mm. long. INFLORESCENCES

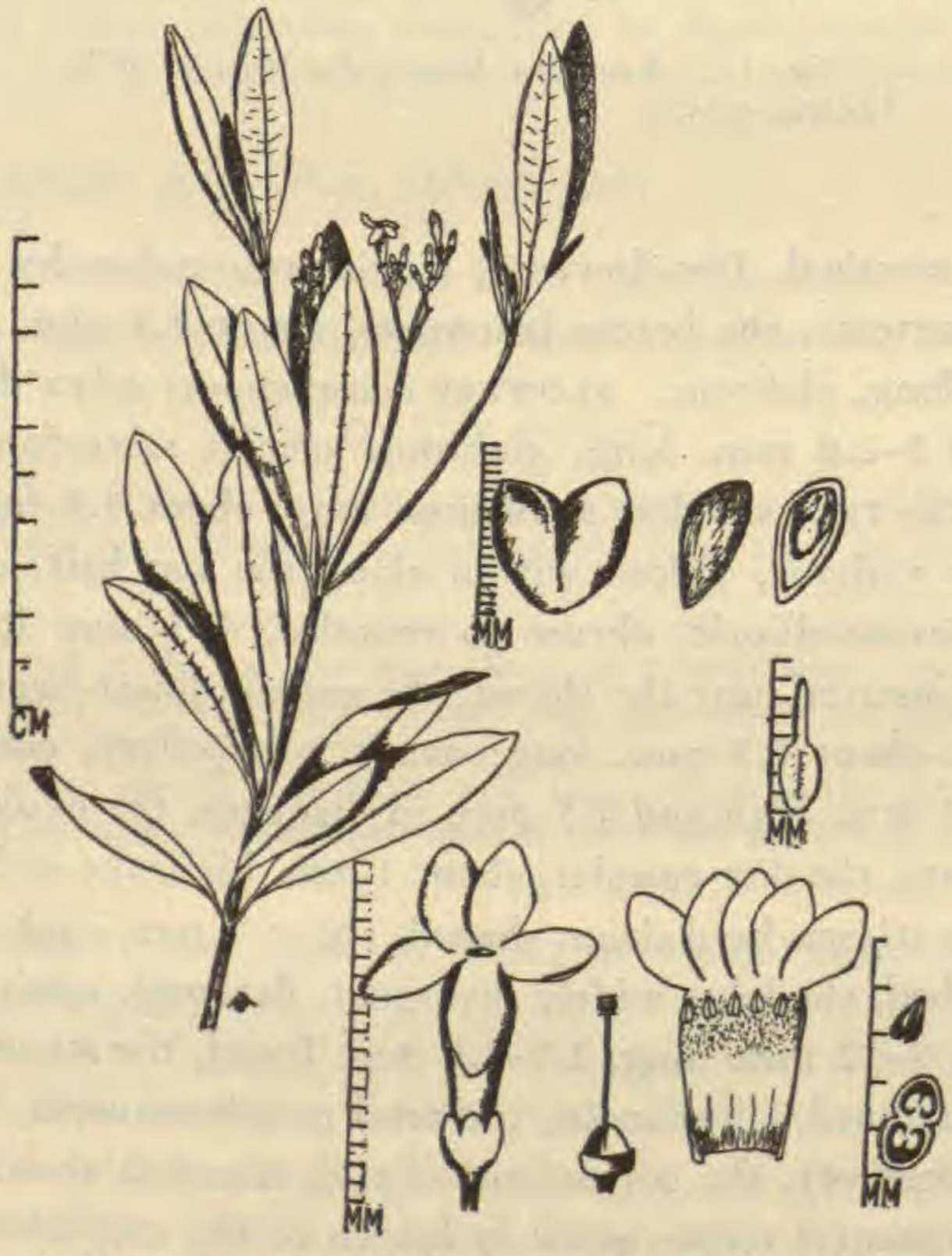

Fig. 18. *Rauvolfia salicifolia* Griseb. *(Wright 1386)*

terminal, few-flowered; peduncles rather stout, 2–6 cm. long, glabrous, bracteate, the bracts ovate, acute, about 1 mm. long, the pedicels rather stout, 2–4 mm. long, glabrous. FLOWERS conspicuous; calyx campanulate, deeply 5-lobed, the lobes occasionally unequal, ovate, obtuse, about 1.5 mm. long, 1 mm. broad, coriaceous, the margin minutely glandular-dentate; corolla salverform, white (Wright), the tube slender, 8–10 mm. long, about 1.5 mm. in diameter at the base, glabrous without and within near the throat and sparsely villous below the stamens, constricted at the throat, the lobes oblique-obovate, rounded, 5–6 mm. long, 3.0–3.5 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, about 1 mm. long, subsessile; ovary 2-carpellary, hemisyncarpous, obovoid, about 2.5 mm. high, 2 mm. in diameter, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style linear, 5–6 mm. long, glabrous, the stigma-head subcapitate, about 1 mm. high, obscurely bilobed. FRUITS obcordate, slightly bilobed, the lobes obliquely obovate, obtuse, broadly acute to obtuse, 13–14 mm. long, 6–8 mm. broad, the stones slightly flattened, faintly rugose, the seed albuminous, the testa membranaceous, the albumen fleshy, the embryo about half as long as the seed, erect, the cotyledons ovate-elliptic, 3.0–3.5 mm. long, 1.5–2.0 mm. broad, the hypocotyl terete, equal in length to the cotyledons.

On limestone hills, in open forests and amongst Pines; flowering from June to November; ripe fruits in January and February. Oriente province in Cuba.

COMMON NAME: Cuba, Oriente—*Corazon de Paloma.*

Rauvolfia salicifolia is closely related to *R. linearifolia* and *R. cubana.* It can be distinguished from the former by its broader, obtuse, coriaceous leaves, the rather stout peduncles with white flowers, the calyx-lobes stiff and obtuse, and the fruits which are obscurely bilobed and obtuse. It can be distinguished from the latter by its narrower and longer leaves, and smaller flowers with the corolla-lobes about half as long as the tube. Like *R. linearifolia,* this species is endemic to Oriente province, Cuba.

CUBA. ORIENTE: *Alain 3310, 3319, 3673* (MO), *Carebia 3823* (NY), *Clement 3566, 3605, 4390* (MO), *Ekman 3322, 3514, 4147, 6145, 6688, 9078* (S), *6329* (P, S), *Howard 5942* (GH, NY, US), *6104* (GH, MO, NY, UC), *Corta 2.038* (W), *Leon & Clement 23046* (MO), *Leon, Clement & Alain 22523* (MO), *Leon, Victorin & Clement 20785* (MO), *Roig 65* (MO), *Shafer 3529, 3687* (GH, NY), *4238* (GH), *8144* (NY), *8364* (NY, US), *Wright 1386* (G, GH, MO, P, S, W), *2946* (G, GH, MO, P, S).

19. RAUVOLFIA CUBANA A. DC. in DC. Prodr. 8:339. 1844. (T.: *Sagra 535, photo*!)

Shrubs or small trees, 2–5 m. tall; branches 2- or 3-chotomous, terete, glabrous, the nodes with distinct pectinate glands limited to the leaf-axils. LEAVES in whorls of 3, scarcely anisophyllous, shortly petiolate, obovate, obtuse, cuneate at the base, 1–6 cm. long, 1–2 cm. broad, coriaceous, lustrous above, opaque beneath, the mid-rib distinct on both surfaces but the secondary veins obscure; petioles 2–4 mm.

long. INFLORESCENCES terminal, few-flowered; peduncles slender, 2–5 cm. long, glabrous, bracteate, the bracts ovate, acute, about 1 mm. long, the pedicels slender, 6–11 mm. long, glabrous, FLOWERS rather large; calyx deeply 5-lobed, the lobes ovate, obtuse, 2–3 mm. long, 1.0–1.5 mm. broad, coriaceous, the margins glandular-dentate; corolla salverform, white, odorous (R. de la Sagra), the tube slender, 12–20 mm. long, about 2 mm. in diameter, glabrous without, villous within near the throat and along the base of the stamens, constricted at the throat, the lobes obovate-elliptic, rounded, 10–14 mm. long, 5–7 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, 1.0–1.5 mm. long, the filament about 1 mm. long; ovary 2-carpellary, hemisyncarpous, cylindrical, about 2.5 mm. high, 2 mm. in diameter, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style filiform, 10-14 mm. long, glabrous, the stigma-head cylindrical, about 1 mm. high, 2-apiculate. FRUITS broadly obcordate, bilobed, the lobes obovate, flattened, broadly acute to obtuse, 10–12 mm. high, 5–7 mm. broad (often only one carpel developing, then the fruit ellipsoid), the stones faintly rugose, the seed albuminous, the testa membranaceous, the albumen fleshy, the

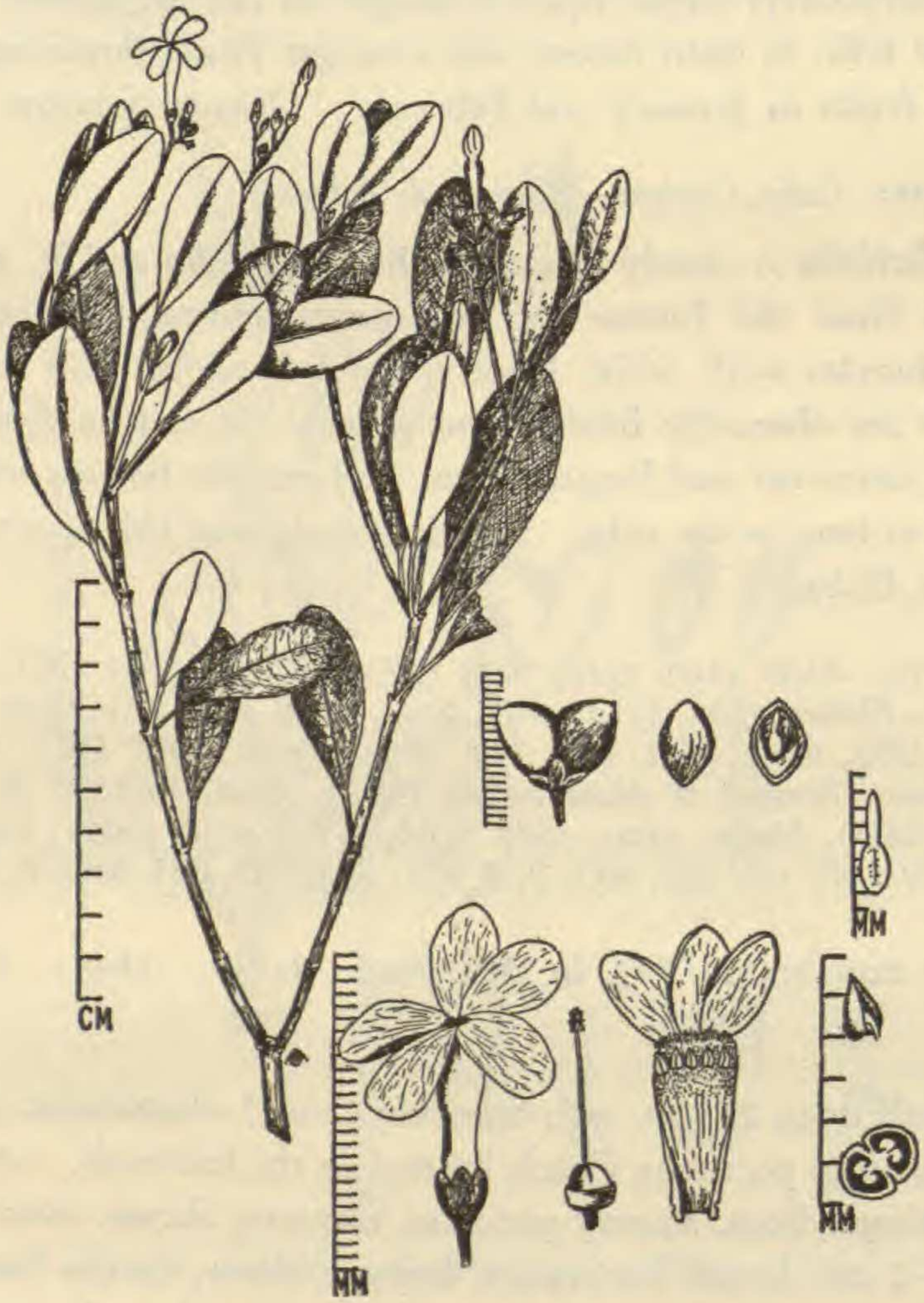

Fig. 19. *Rauvolfia cubana* A. DC. *(Wright 2947)*

embryo erect, a little more than half as long as the seed, the cotyledons elliptic, about 3 mm. long, 2 mm. broad, the hypocotyl terete, as long as the cotyledons.

On limestone hills, in savannas and in swampy regions along river banks; flowering from April to August; ripe fruits in October to December, western Cuba, and the Isle of Pines.

Rauvolfia cubana resembles *R. salicifolia* very much but can be distinguished from it by its larger flowers with the calyx-lobes larger, the corolla-lobes about as long as the tube and the throat villous, and the broadly obcordate, smaller fruits. *R. cubana* also is an endemic of Cuba, but confined to the western provinces and the Isle of Pines.

CUBA. HAVANA: *N. L. Britton, Cowell & C. de LaTerre 13345* (NY), *Ekman 10022, 12583* (S), *Leon 5208* (NY), *Leon, Ekman et al, 9096* (NY), *Leon & Roca 7712* (NY), *L. C. Richard 13* (P), *Roig 3* (NY), *Shafer 72* (NY). PRECISE LOCALITY UNKNOWN: *Sagra 414, 815* (P), *Wright 2947* (G, GH, MO, NY, P, S, US, W). ISLE OF PINES: *N. L. Britton & Wilson 14876* (GH, NY, US), *Ekman 11842* (S), *Jennings 212, 615* (GH, NY, US), *Killip 44082* (US). PINAR DEL RIO: *N. L. Britton & Cowell 9987* (NY), *N. L. & E. G. Britton & Gager 7014* (NY, US), *N. L. Britton & Gager 7328* (US), *Leon & Charles 4914* (NY). SANTA CLARA (LAS VILLAS): *N. L. Britton, Earle & Wilson 4599* (NY), *N. L. Britton & Wilson 5744* (US), *Combs 245* (G, GH, MO, NY, P), *Ekman 17069* (S), *Jack 7540* (A, NY, S, US), *8684* (A, NY, S), *Leon 9246* (NY), *Van Hermann s. n.* (L).

SUBSERIES 2. **ANDINAE** (Mgf.) A. S. Rao, stat. nov.

§ *ANDINAE* Mgf. in Fedde, Rep. Spec. Nov. 20:118. 1924.

KEY TO THE SPECIES

A. Leaves 3 times as long as broad. Corolla-tube 5–6 mm. long, the throat villous; calyx-lobes cuspidate, the margin entire. Andes of Bolivia and northern Argentina.....20. *R. schueli*
AA. Leaves 4 times as long as broad. Corolla-tube 8–12 mm. long, the throat glabrous; calyx-lobes lanceolate, the margin glandular-dentate. Andes of Peru.....21. *R. andina*

20. RAUVOLFIA SCHUELI Speg. in Physis 3:337. 1917, *ex char.* (T.: *Spegazzini s. n.*)

R. boliviana Mgf. in Fedde, Rep. Spec. Nov. 20:122. 1924. (T.: *Hieronymus & Lorentz 962, photo*!)

Shrubs or small trees 2–6 m. tall; branches 2-, 3- or 4-chotomous, terete, sparsely lenticellate, the bark grayish and slightly wrinkled longitudinally, the nodes with glands confined to the leaf-axils. LEAVES in whorls of 3 or 4, scarcely anisophyllous, long-petiolate, elliptic, acuminate, attenuate at the base, 4–12 cm. long, 1–4 cm. broad, membranaceous to subcoriaceous, opaque on both surfaces, the secondary veins many, arcuate, rather obscure above and more distinct beneath; petioles 1–2 cm. long. INFLORESCENCES terminal, many-flowered, corymbose; peduncles slender, 2–4 cm. long, glabrous, bracteate, the bracts ovate, acute, about 1 mm. long, the pedicels slender, 3–6 mm. long, glabrous. FLOWERS conspicuous; calyx deeply 5-lobed, the lobes cuspidate, acuminate, about 2 mm. long; corolla

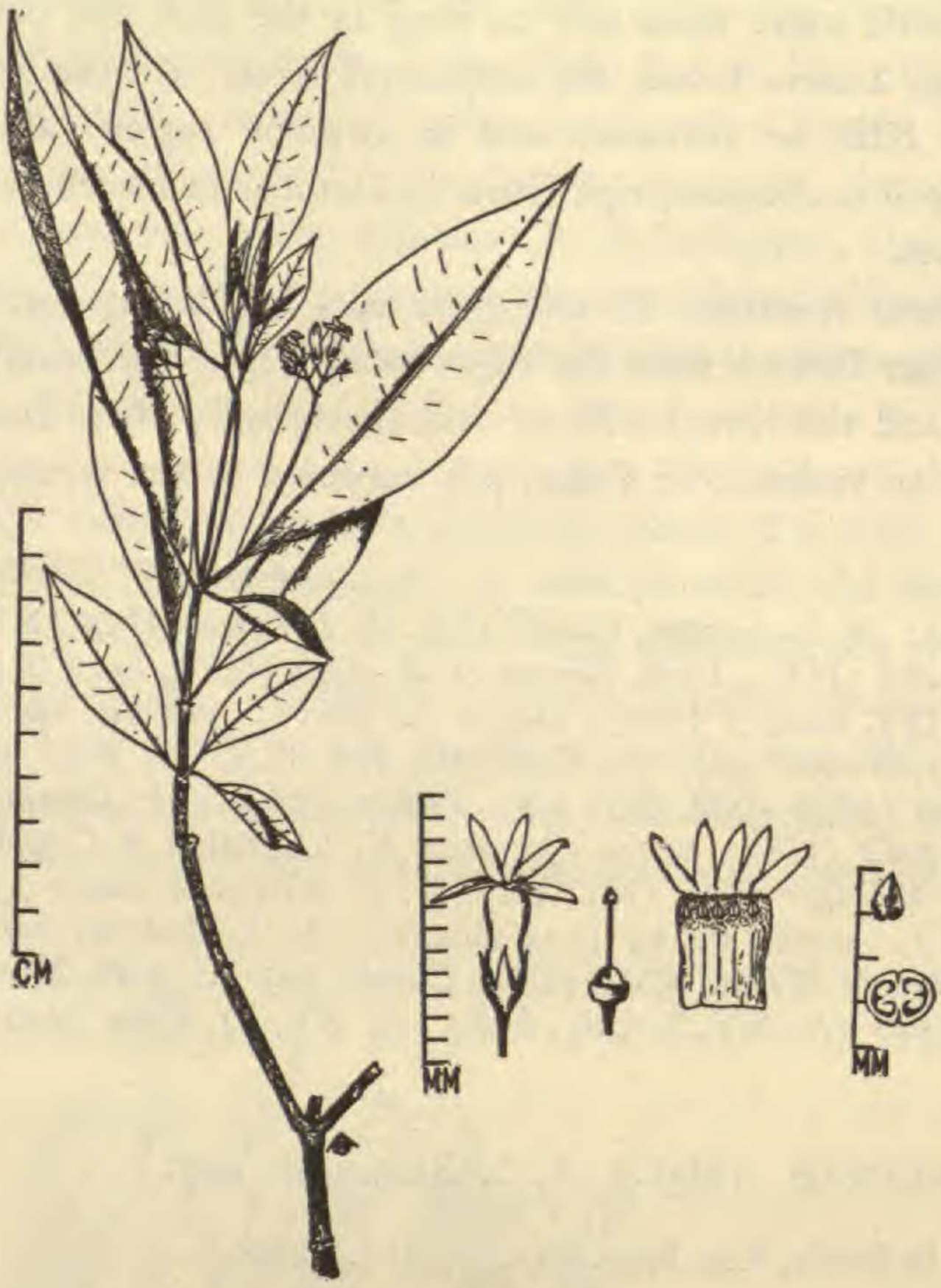

Fig. 20. *Rauvolfia schueli* Speg. *(Venturi 9634)*

salverform, white, fragrant (Pearce), the tube slender, 5–6 mm. long, about 1.5 mm. in diameter, glabrous without and sparsely pilose within near the throat, constricted at the throat, the lobes ovate-oblong, acute, 3.0–3.5 mm. long, about 1 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, about 1 mm. long, subsessile; ovary 2-carpellary, hemisyncarpous, ovoid, about 2 mm. high, 1.5 mm. broad, the ovules 2 in each locule on an axile placenta, the disc annular, about 0.5 mm. high, the style linear, 3.0–3.5 mm. long, glabrous, the stigma-head cylindrical, with a hairy corona at the base, about 0.5 mm. high, 2-apiculate.

I have not seen any fruits. Spegazzini has described the drupes as reniform, about 10 mm. in diameter and 5–6 mm. high, blue-black. Markgraf has described the mericarps as subglobose, 2-seeded, 5 mm. broad, 7 mm. high, black.

Densely branching shrubs or small trees in open woods and in sandy loam; flowering from May to October. The Andean regions of Bolivia and northern Argentina.

COMMON NAME: Bolivia—*Lecheron del Monte.*

I have not seen Spegazzini's type of *R. schueli.* All efforts to locate the specimen in the important herbaria of Argentina have been in vain. However, Dr.

Theodoro Meyer of the National University of Tucumán, who has collected the species from both type localities and has studied them extensively, informs me that he considers *R. boliviana* of Markgraf synonymous with *R. schueli.* Evidently Markgraf was unaware of Spegazzini's species when he described *R. boliviana.* I agree with Dr. Meyer and am including *R. boliviana* under *R. schueli.*

ARGENTINA. JUJUY: San Pedro, near Río Lavagin, southeast of San Pedro de Jujuy, *Eyerdam & Beetle 22524,* (GH, UCL); Sierra de Santa Barbara, *Venturi 9634,* (GH, S). SALTA: Yaquiasmé, *Meyer 18.003* (MO).

BOLIVIA: precise locality not known, *Pearce s. n., K. no. 2253/54* (K).

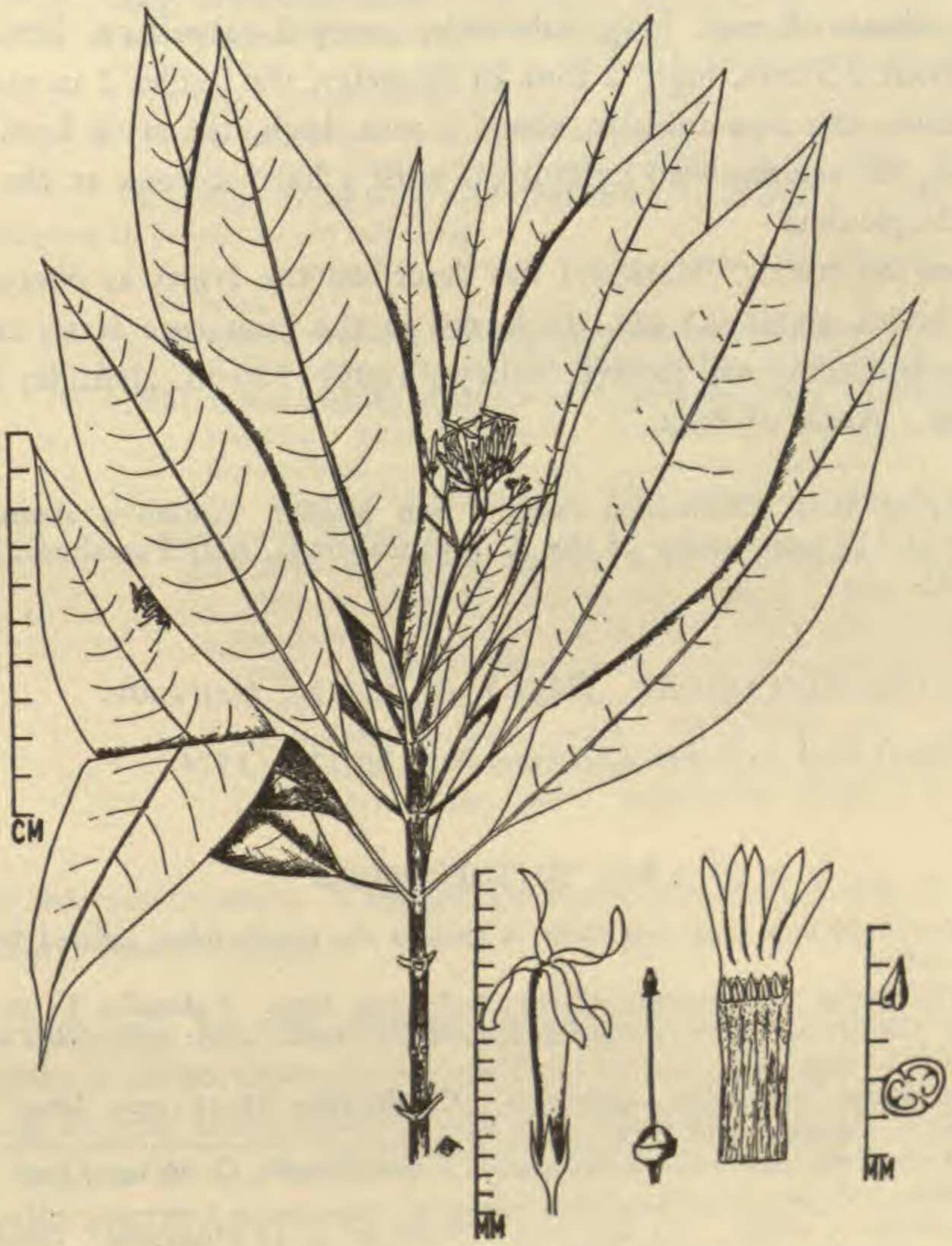

Fig. 21. *Rauvolfia andina* Mgf. *(Weberbauer 7112)*

21. RAUVOLFIA ANDINA Mgf. in Fedde, Rep. Spec. Nov. 20:122. 1924. (T.: *Weberbauer 7112*!)

Shrubs 5–7 m. tall; branches terete, sparsely lenticellate, the bark gray, slightly wrinkled, the nodes with glands confined to the leaf-axils. LEAVES in whorls of 3 or 4, scarcely anisophyllous, long-petiolate, elliptic-oblong, acuminate, attenuate

at the base, 8–20 cm. long, 2–5 cm. broad, membranaceous, the secondary veins many, obscure above, a little more distinct beneath; petioles 2–3 cm. long. INFLORESCENCES terminal, many-flowered, corymbose; peduncles stout, 1–5 cm. long, glabrous, bracteate, the bracts ovate, acute, about 1 mm. long, the pedicels slender, 4–6 mm. long, glabrous. FLOWERS relatively large; calyx deeply 5-lobed, the lobes lanceolate, acuminate, 2.0–2.5 mm. long, the margin glandular-dentate; corolla salverform, white, the tube slender, 8–12 mm. long, about 1.5 mm. in diameter at the base, glabrous without and within near the throat, but sparsely villous below the stamens, constricted at the throat, the lobes linear, acute, 5–6 mm. long, 1.0–1.5 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, about 1.5 mm. long, subsessile; ovary 2-carpellary, hemisyncarpous, cylindrical, about 2.5 mm. high, 2 mm. in diameter, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style linear, 7–8 mm. long, glabrous, the stigma-head cylindrical with a hairy corona at the base, about 1 mm. high, 2-apiculate.

I have seen no fruits. Markgraf has described the fruits as obcordate, 1 cm. high, 1 cm. broad, about 0.5 cm. thick, red in the immature state, and 2-seeded.

On rocky and stony soil in river valleys, 1200–1700 m. altitude; flowering in April and May. Andes of Peru.

PERU. CAJAMARCA: Cajamarca, cerca a San Miguel, camino a Asuncion, *Ramon Ferreyra 7086* (US); Jaen, valley of the R. Huancabamba, near Pomahuaca, *Weberbauer 7112* (GH, US).

SUBSERIES 3. **GRANDIFLORAE** (Mgf.) A. S. Rao, stat. nov.

§ *GRANDIFLORAE* Mgf. in Fedde, Rep. Spec. Nov. 20:116. 1924.

KEY TO THE SPECIES

A. Corolla-tube 10–20 mm. long, 2–3 times as long as the corolla-lobes, inflated 2–3 mm. below the orifice.
  B. Leaves oblanceolate or narrowly elliptic, 5–20 cm. long. Peduncles 8- to many-flowered. Corolla-tube 2.5–3.0 times as long as the corolla-lobes; calyx-lobes ovate or deltoid, 1.0–1.5 mm. long.
    C. Leaves distinctly petiolate, coriaceous. Corolla-tube 10–12 mm. long. Fruits reniform. Colombia and Peru.....22. *R. sanctorum*
    CC. Leaves obscurely petiolate, membranaceous. Corolla-tube 12–20 mm. long. Fruits obcordate. Eastern Brazil.....23. *R. grandiflora*
  BB. Leaves obovate or elliptic, 2–4 cm. long. Peduncles 1- to 6-flowered. Corolla-tube about 2 times as long as the corolla-lobes; calyx-lobes lanceolate, 2.5–3.0 mm. long. Eastern Brazil.....24. *R. paucifolia*
AA. Corolla-tube 4–9 mm. long, about as long as or 1.5 times as long as the corolla-lobes (except in *R. sessilifolia* 10 mm.), not inflated or inflated immediately at the orifice.
  D. Leaves sessile or with petioles 2–10 mm. long.
    E. Leaves sessile or with petioles 2–4 mm. long. Corolla-tube 8–10 mm. long.
      F. Leaves membranaceous, ovate to oblong-ovate, sessile. South-central Brazil. .....25. *R. sessilifolia*
      FF. Leaves coriaceous, broadly or narrowly elliptic; petioles 2–4 mm. long. South-central Brazil.....26. *R. weddelliana*
    EE. Leaves with petioles 5–10 mm. long. Corolla-tube 4–7 mm. long.

G. Leaves abruptly attenuate at the base, upper surface opaque, secondary veins distinct, 4–5 mm. apart. Inflorescences longer than the subtending leaf, with ternately or quaternately divided peduncles. Calyx-lobes oblong-ovate, obtuse. Venezuela.....27. *R. steyermarkii*

GG. Leaves gradually attenuate at the base, upper surface lustrous, with many distinct secondary veins 1–3 mm. apart, or upper surface opaque with obscure secondary veins. Inflorescences with dichotomously branched peduncles, about as long as the subtending leaf. Calyx-lobes ovate, acute or rounded.

H. Leaves mostly in whorls of 4, elliptic, upper surface lustrous with innumerable secondary veins 1–3 mm. apart. Pedicels stout, 4–8 mm. long; calyx-lobes rounded. Antilles.....28. *R. nitida*

HH. Leaves mostly in whorls of 3, oblanceolate or obovate, upper surface opaque with obscure secondary veins. Pedicels slender, 10–15 mm. long; calyx-lobes acute.

I. Leaves membranaceous or subcoriaceous. Cymules umbellate; corolla-tube about 2 times as long as the corolla-lobes; ovary free almost to the base. Northeast Brazil.....29. *R. bahiensis*

II. Leaves coriaceous. Cymules corymbose; corolla-tube about as long as the corolla-lobes; ovary fused almost to the top. Dominican Republic, Guadeloupe and Dominica.....30. *R. biauriculata*

DD. Leaves with petioles 12–40 mm. long.

J. Leaves obovate or obovate-oblong, coriaceous, opaque on both surfaces.

K. Leaves usually in whorls of 4, obovate, secondary veins arcuate. Calyx-lobes acute; corolla purpurascent. Panama.....31. *R. purpurascens*

KK. Leaves usually in whorls of 3, obovate-oblong to elliptic-oblong, secondary veins transverse. Calyx-lobes obtuse; corolla white. Costa Rica.....32. *R. sarapiquensis*

JJ. Leaves elliptic, coriaceous or membranaceous, opaque on both surfaces or lustrous above.

L. Leaves coriaceous, lustrous above. Secondary and tertiary peduncles slender. Corolla-tube slender, about 1 mm. in diameter at the base, reddish-violet; calyx-lobes about 1 mm. long. Ovary hemisyncarpous. Peru and Bolivia.....33. *R. praecox*

LL. Leaves membranaceous, opaque on both surfaces. Secondary and tertiary peduncles stout. Corolla-tube stout, about 1.5 mm. in diameter at the base, white; calyx-lobes about 1.5 mm. long. Ovary apocarpous. Southeastern Brazil.....34. *R. sellowii*

22. RAUVOLFIA SANCTORUM Woodson, in Ann. Mo. Bot. Gard. 18:543. 1931. (T.: *Killip & Smith 15392*!)

Trees 3–4 m. tall; branches slender, drooping, terete, the bark olive-gray, glabrous, the nodes with pectinate glands confined to the leaf-axils. LEAVES in whorls of 3, rarely 4, slightly anisophyllous, long-petiolate, elliptic to elliptic-oblanceolate, acuminate, cuneate at the base, 8–20 cm. long, 3–8 cm. broad, coriaceous, the secondary veins equally prominent on both surfaces, many, arcuate; petioles stout, 1–3 cm. long. INFLORESCENCES terminal, solitary or paired, few-flowered; peduncles slender, 2–5 cm. long, glabrous, bracteate, the bracts ovate, acute, about 1 mm. long, the pedicels slender, 4–8 mm. long, glabrous. FLOWERS conspicuous; calyx deeply 5-lobed, the lobes ovate, acuminate, about 1.5 mm. long; corolla infundibuliform, white, the tube slender, 10–12 mm. long, about 1.5 mm. in diameter, glabrous without and within the orifice, but distinctly pilose near the tip and base of the stamens, the throat dilated 2–3 mm. below the orifice, the lobes

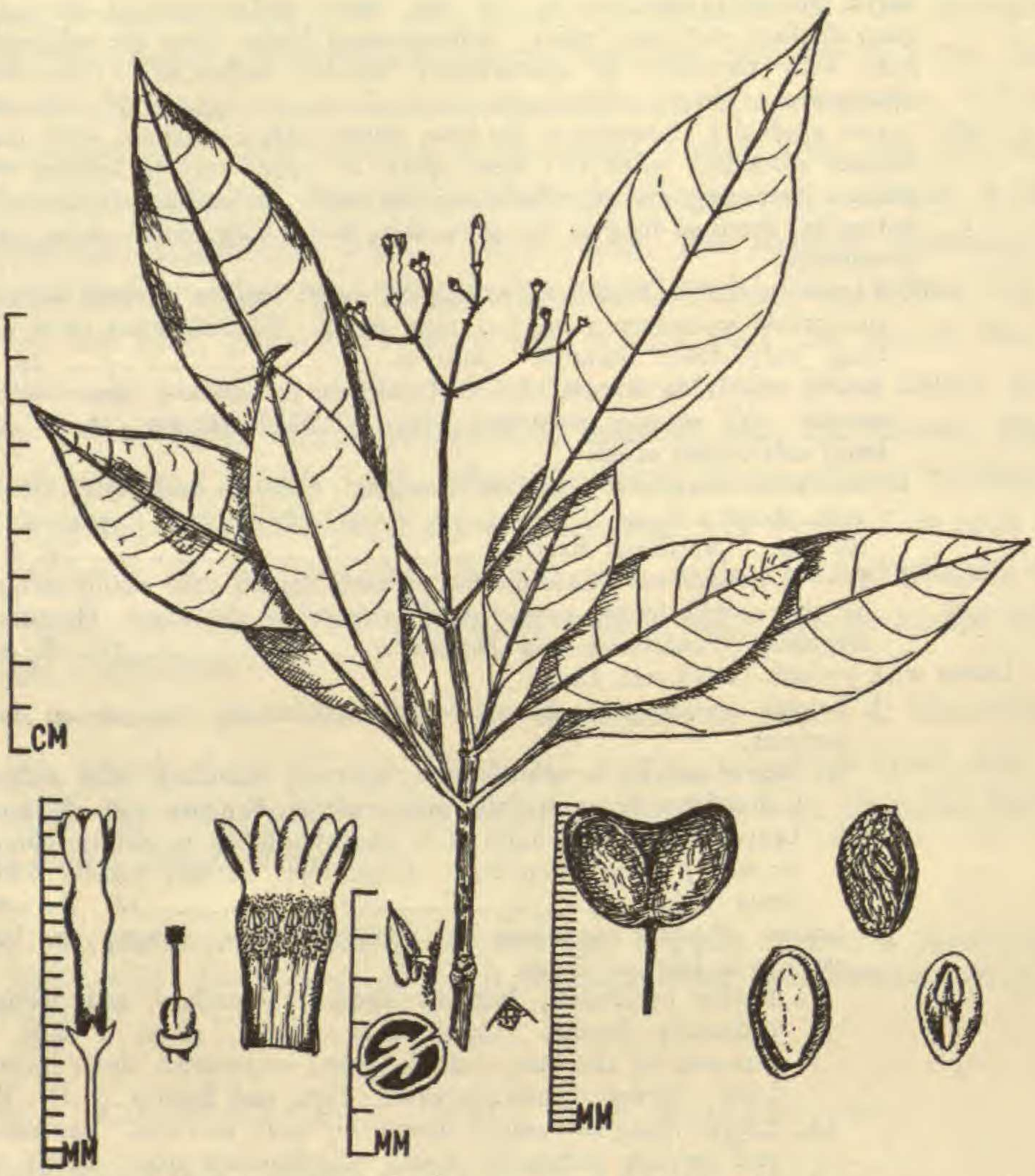

Fig. 22. *Rauvolfia sanctorum* Woodson *(Killip & Smith 15392)*

obovate-oblong, about 4 mm. long, 2 mm. broad; stamens 5, inserted 2–3 mm. below the orifice, the anthers ovate, acuminate, about 2 mm. long, subsessile; ovary 2-carpellary, connate at the base, obovoid, about 3 mm. high, 2 mm. broad, the ovule 1 in each locule on a ventral placenta, the disc annular, about 1 mm. high, the style slender, 4–5 mm. long, glabrous, the stigma-head broadly drum-shaped, about 1 mm. high, obscurely bilobed. FRUITS reniform, 2-seeded, the lobes 13–15 mm. high, 7–9 mm. broad, the stones broadly ellipsoid, a little compressed, faintly rugose, the seed albuminous, the testa membranaceous, the albumen fleshy, the embryo erect, the cotyledons ovate, obtuse, about 4 mm. long, 2 mm. broad, the hypocotyl terete, as long as the cotyledons, superior.

In dense forests, along the slopes of hills, 100 to 1500 m. altitude; flowering and fruiting November to December. Colombia and Peru.

This is closely related to *R. grandiflora* but differs from it by its stout-petioled, somewhat leathery leaves, the few-flowered inflorescences, and the kidney-shaped fruits. The geographical distribution is also different.

COLOMBIA. SANTANDER: northern slopes of Mesa de los Santos, *Killip & Smith 15315* (GH, NY, US), *15392* (A, GH, MO, NY, S, US).
PERU. LORETO: Mishuhuaca near Iquitos, *Killip & Smith 29928* (US).

23. RAUVOLFIA GRANDIFLORA Mart. ex A. DC. in DC. Prodr. 8:341. 1844. (T.: *Martius 908*!)

R. affinis Muell.-Arg. in Mart. Fl. Bras. 6^1:34. 1860. (T.: *Sellow s. n., photo*!)
R. affinis var. *subulata* Muell.-Arg. *l. c. ex char.* (T.: *Sellow 315*)

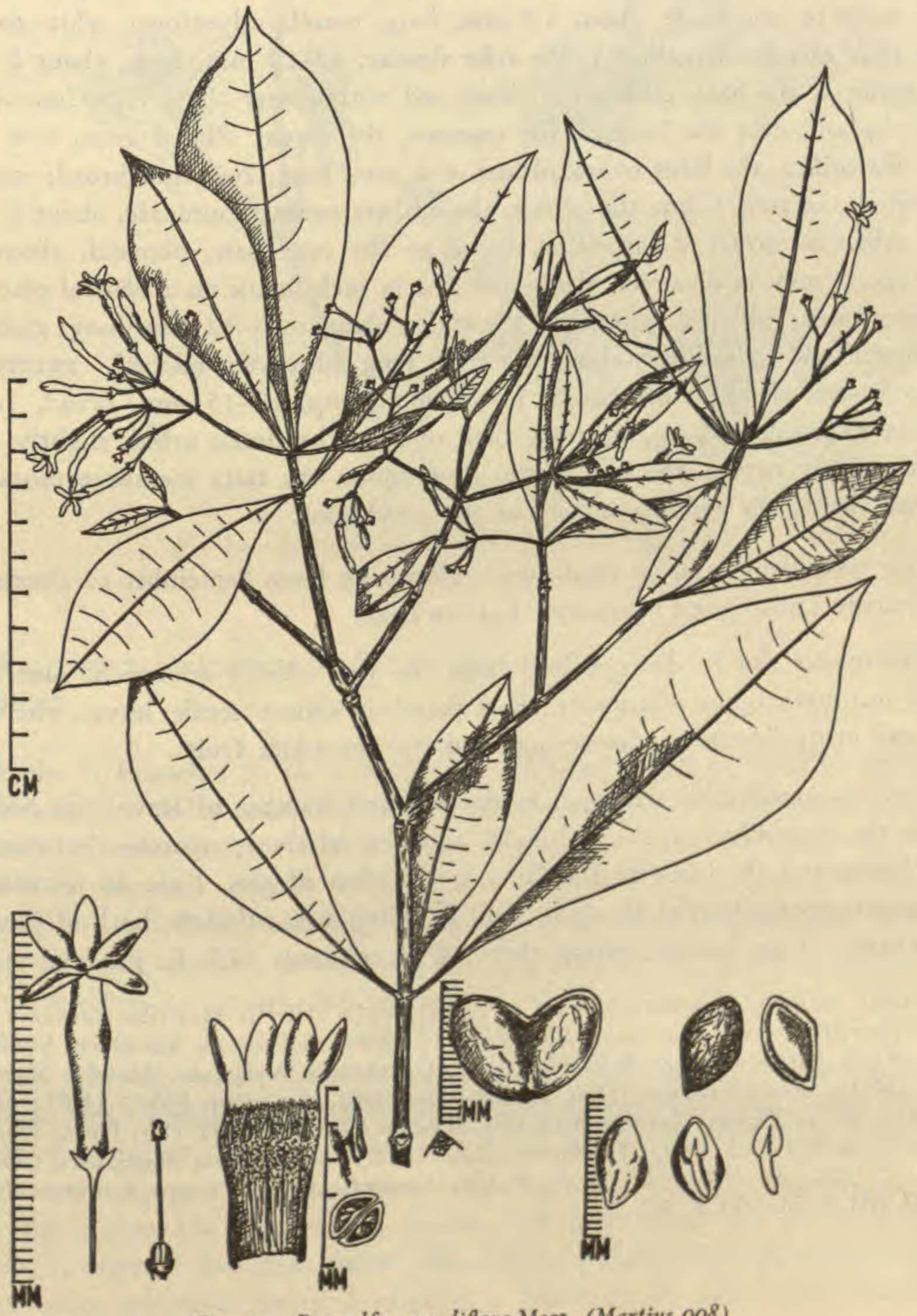

Fig. 23. *Rauvolfia grandiflora* Mart. *(Martius 908)*

Shrubs 1–6 m. tall; branches 2-, 3- or 4-chotomous, terete, glabrous, the nodes with pectinate glands confined to the leaf-axils. LEAVES in whorls of 3 or 4, slightly anisophyllous, shortly petiolate to subsessile, obovate to oblong-lanceolate, acuminate, cuneate at the base, 5–15 cm. long, 1.5–4.5 cm. broad, membranaceous, the secondary veins equally evident on both surfaces, several, arcuate; petioles slender, 2–5 mm. long, or absent. INFLORESCENCES terminal and lateral, few- to many-flowered; peduncles slender, 1–4 cm. long, glabrous, the pedicels slender, 8–12 mm. long, glabrous. FLOWERS relatively large; calyx deeply 5-lobed, ovate, acute to acuminate, about 1.5 mm. long; corolla salverform, white to pale violet (*fide* Mendes Magalhaes), the tube slender, 12–20 mm. long, about 2 mm. in diameter at the base, glabrous without and within near the orifice, but villous at the tip and near the base of the stamens, the throat dilated from 3–4 mm. below the orifice, the lobes ovate, obtuse, 4–8 mm. long, 2–3 mm. broad; stamens 5, inserted 3–4 mm. below the orifice, the anthers ovate, acuminate, about 2 mm. long, subsessile; ovary 2-carpellary, fused at the very base, obovoid, about 2.5 mm. high, 2 mm. in diameter, the ovules 1–2 in each locule on a ventral placenta, the disc annular, about 1 mm. high, the style columnar, 8–12 mm. long, glabrous, the stigma-head cylindrical, about 1.5 mm. long, obscurely bilobed. FRUITS obcordate, 2-seeded, the lobes ovoid, 15–20 mm. long, 10–15 mm. broad, (often only one carpel developing, then the fruit ovoid), the stones ovoid, slightly compressed, faintly rugose, the seed ovate, albuminous, the testa membranaceous, the albumen fleshy, the embryo as long as the cotyledons.

Near river banks and on road-sides. Flowering from September to December; ripe fruits in January and February. Eastern Bazil.

This species can be distinguished from the very closely related *R. sanctorum* by its membranaceous, extremely short-petioled, almost sessile leaves, the more open and many-flowered inflorescences and the obcordate fruits.

There is considerable variation in the size and number of leaves per node, as also in the branching of the peduncles and the relative proportion between the corolla-tube and the lobes of the flowers. In view of this, I see no justification for separate recognition of *R. affinis*, and *R. affinis* var. *subulata*, both of Mueller-Argoviensis. I am hence treating them as synonymous with *R. grandiflora*.

BRAZIL. BAHIA: *Blanchet 105* (P), *211* (G), *2314* (G, P); Muritiba, *Blanchet 3468* (W). ESPIRITO SANTO: Rio Doce, *Kuhlman 121* (RB); Goitacozes, Rio Doce, *Kuhlmann 6448* (RB); MINAS GERAES: Belo Horizonte, Governador Valadares, *Mendes Magalhaes 4.431* (MO). PERNAMBUCO: Dois Irmãos, Rio Garca, *Autenour 89627* (RB); RIO DE JANEIRO: Rio de Janeiro, *Baretto 4014* (F), *Glaziou 639* (P), *7751* (P), *Horto Florestal, RB 61277, 62875* (RB, MO), *Kuhlmann 42421* (RB); Santa Maria Magdalena, *Constantino 2757* (RB), *St. Hilaire* b^2*197* (F, P, US). PRECISE LOCALITY NOT KNOWN: *Martius 908* (G, GH, L, M, MO, P, W).

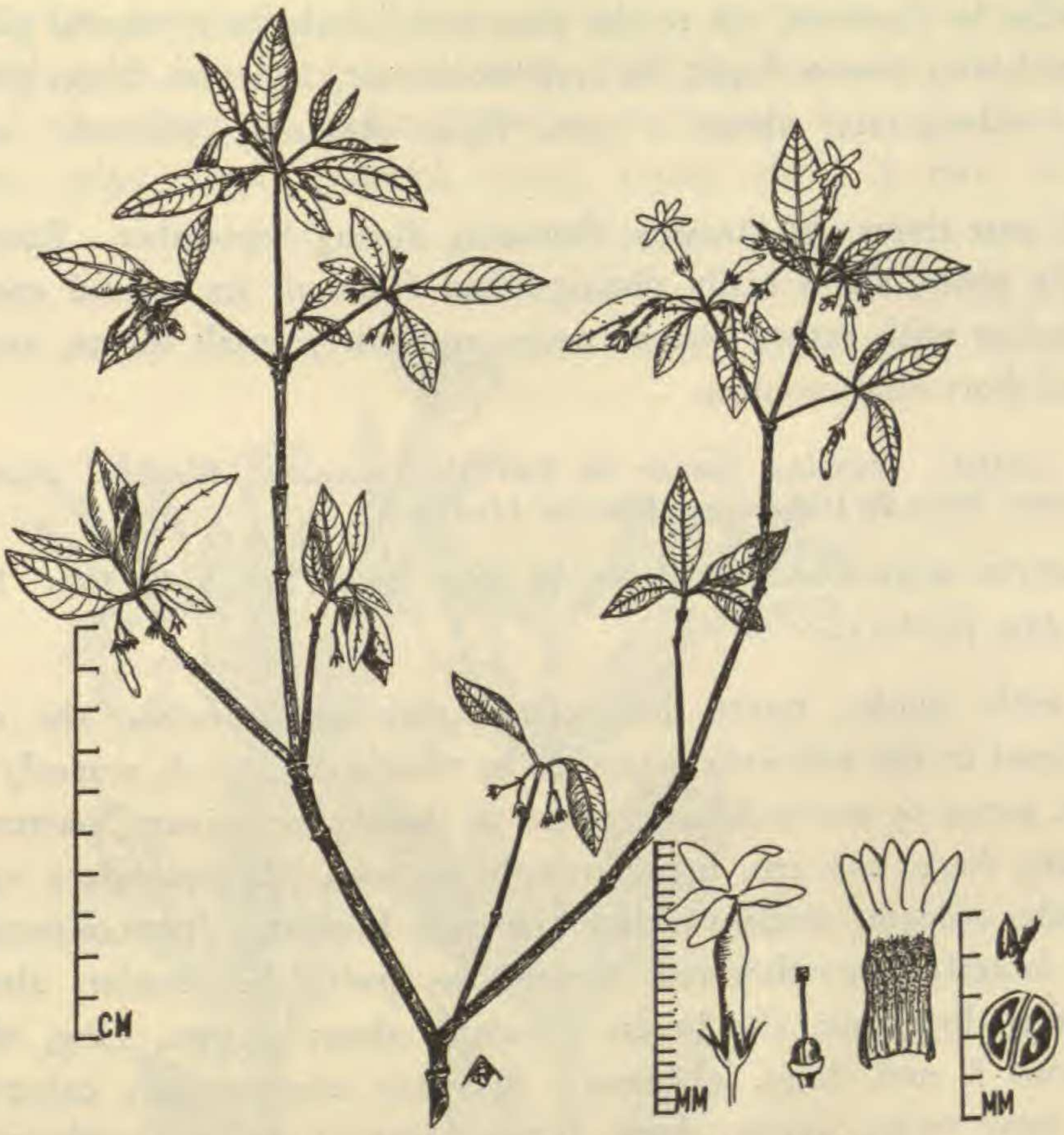

Fig. 24. *Rauvolfia paucifolia* A. DC. *(Blanchet 2920)*

24. RAUVOLFIA PAUCIFOLIA A. DC. in DC. Prodr. 8:340. 1844. (T.: *Blanchet 2920*!)

Shrubs ?; branches 2- or 4-chotomous, slender, terete or slightly 4-angular, lenticellate, the nodes relatively distant, with pectinate glands confined to the leaf-axils. LEAVES in whorls of 4 or sometimes 3, slightly anisophyllous, shortly petiolate to subsessile, elliptic or obovate, acuminate, attenuate at the base, 2–4 cm. long, 1–2 cm. broad, membranaceous, the secondary veins 6–10 pairs, arcuate, distinct on both surfaces; petioles slender, 2–4 mm. long, or absent. INFLORESCENCES terminal or lateral, few-flowered; peduncles slender, 0.5–2.0 cm. long, glabrous, minutely bracteate, the pedicels slender, 8–12 mm. long, glabrous. FLOWERS relatively large; calyx deeply 5-lobed, the lobes lanceolate, acuminate, 2–3 mm. long; corolla salverform, the tube slender, 10–12 mm. long, about 2 mm. in diameter at the base, glabrous without and within near the orifice, but villous at the tip and near the base of the stamens, the throat dilated 2–3 mm. below the orifice, the lobes ovate, obtuse, 4–5 mm. long, 2.0–2.5 mm. broad; stamens 5, inserted 2–3 mm. below the orifice, the anthers ovate, acute, about 1 mm. long, subsessile; ovary 2-carpellary, fused at the very base, subglobose,

about 2.5 mm. in diameter, the ovules 2 in each locule on a ventral placenta, the disc annular, about 1 mm. high, the style columnar, 3–4 mm. long, glabrous, the stigma-head subcapitate, about 1 mm. high, obscurely bilobed. FRUITS not known.

On hills near rivers and streams; flowering during September. Eastern Brazil.

Rauvolfia paucifolia is easily distinguished from all its related species by its slender branches with rather distant nodes and fairly small leaves, and the very few-flowered short inflorescences.

BRAZIL. BAHIA: Jacobina, Serato do Rio São Francisco, *Blanchet 2920* (G, W). ESPIRITO SANTO: Serra do Itabapoana, *Glaziou 11182* (P).

25. RAUVOLFIA SESSILIFOLIA S. Moore, in Jour. Bot. (Brit.) 42:103. 1904. (T.: *Robert 494, photo*!)

Plants with slender, terete, lenticellate, glabrous branches, the nodes with glands confined to the leaf-axils. LEAVES in whorls of 3 to 4, scarcely anisophyllous, sessile, ovate to ovate-oblong, acute to shortly acuminate, narrowed at the base, 5–8 cm. long, 2–4 cm. broad, membranaceous, the secondary veins 10–16 pairs, slightly arcuate, evident above, obscure beneath. INFLORESCENCES terminal and lateral, many-flowered, corymbose; peduncles slender, about 3 cm. long, glabrous, bracteate, the bracts subulate, about 2 mm. long, the pedicels slender, about 5 mm. long, glabrous. FLOWERS conspicuous; calyx deeply 5-lobed, the lobes ovate, acute, about 1 mm. long; corolla salverform, the tube slender, about 10 mm. long, glabrous without and within, except near the stamens, pilose; stamens 5, inserted near the throat, the anthers linear, about 1.5 mm. long; ovary 2-carpelled, oblong, obtuse, about 2 mm. high, the disc annular, about 1 mm. high. FRUITS not known.

Flowering in September. South-central Brazil.

According to Spencer Moore, *R sessilifolia* is closely related to *R. weddelliana,* but differs from it by its ovate or ovate-oblong sessile leaves, its shorter pedicels and the corolla-tube about twice as long as the lobes.

26. RAUVOLFIA WEDDELLIANA Muell.-Arg. in Mart. Fl. Bras. 6^1:32. 1860. (T.: *Weddel 2966*!)

R. elliptica Malme, in Bihang till K. Sv. Vet.-Akad. Handl. Afd. III. 24^{10}:13. 1899. (T.: *Malme 1444B*!)

Shrubs or subshrubs 0.5–1.0 m. tall; branches few, slender, terete, glabrous, not lenticellate, the nodes with pectinate glands confined to the leaf-axils. LEAVES in whorls of 3 to 4, scarcely anisophyllous, shortly petiolate, broadly to narrowly elliptic, acute to short-acuminate, narrowed at the base, 5–11 cm. long, 1–4 cm. broad, subcoriaceous to coriaceous, the secondary veins 12–18 pairs, slightly arcuate and meeting on either side to form a delicate marginal vein, a little obscure above, more distinct beneath; petioles slender, 2–4 mm. long.

INFLORESCENCES terminal and lateral, geminate or ternate, many-flowered, corymbose; peduncles slender, 3–4 cm. long, glabrous, bracteate, the bracts lanceolate, about 2 mm. long, the pedicels slender, 5–12 mm. long, glabrous. FLOWERS conspicuous; calyx deeply 5-lobed, ovate, acute, about 2 mm. long, corolla

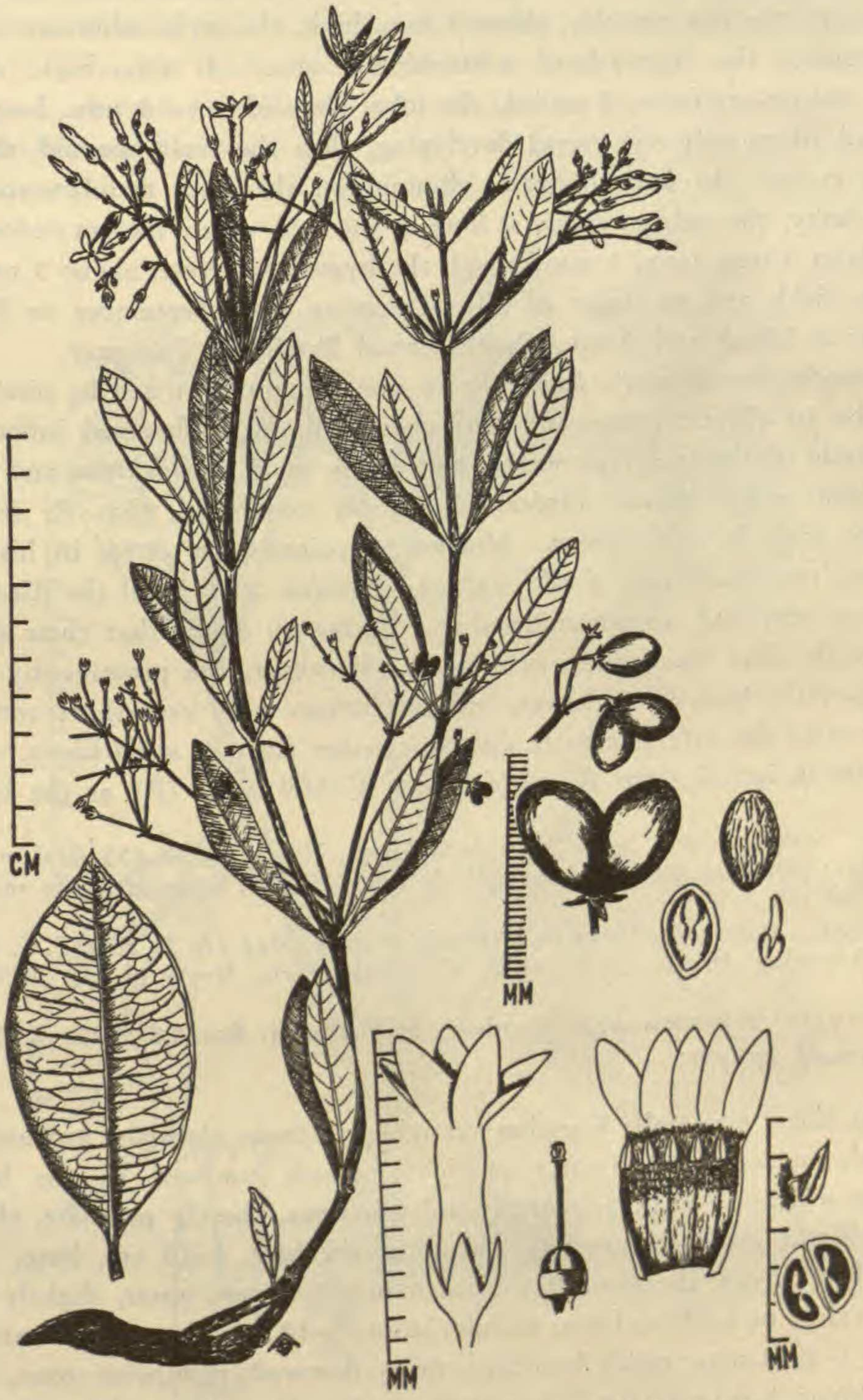

Fig. 25. *Rauvolfia weddelliana* Muell.-Arg. *(Hassler 10696)*

salverform, roseate (*fide* Hassler), the tube slender, cylindrical, 8–9 mm. long, about 2 mm. in diameter at the base, glabrous without, villous within near the throat and near the stamens, the lobes ovate, broadly acute to obtuse, 4–5 mm. long, about 2 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute to acuminate, about 2 mm. long, subsessile; ovary 2-carpellary, hemisyncarpous, subspherical, about 2 mm. in diameter, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style columnar, 3–4 mm. long, glabrous, the stigma-head subturbinate, about 1 mm. high, obscurely bilobed. FRUITS reniform, 2-seeded, the lobes obovoid, 14–16 mm. long, 10–13 mm. broad, often only one carpel developing, then the fruit obovoid, the stones distinctly rugose, the seeds obovate, albuminous, the testa membranaceous, the albumen fleshy, the embryo about as long as the seed, erect, the cotyledons ovate, obtuse, about 4 mm. long, 3 mm. broad, the hypocotyl terete, about 5 mm. long.

In dry fields and on slopes of hills; flowering from September to February; ripe fruits in March and April. South-central Brazil and Paraguay.

This species resembles *R. paucifolia* to some extent, but can be distinguished from it by its elliptic leaves and long-peduncled, many-flowered inflorescences.

My study of the two type sheets respectively of *R. weddelliana* and *R. elliptica* confirms what Spencer Moore had already concluded, that *R. elliptica* is conspecific with *R. weddelliana.* Mueller-Argoviensis has cited, in his original description, two specimens: *Riedel 637* and *Weddell 2966.* All the Riedel sheets that I have examined are unnumbered but I have no doubt that these sheets are isotypic with what Mueller has mentioned. However, the prominently lenticellate twigs with oblanceolate leaves, and the flowers with very short corolla-tube and lobes make this referable to *R. bahiensis* rather than *R. weddelliana.* Accordingly, I am designating for *R. weddelliana, Weddel 2966* (P) as the type.

BRAZIL. MATO GROSSO: Santa Anna da Chapada, *Malme 1444B* (S), *Malme s. n.* (G, S, UPS, US); precise locality not known, *Robert s. n.* (MO); between Goyaz and Cujaba, *Weddell 2966* (P).

PARAGUAY. AMAMBAY: Sierra de Maracaju, *Hassler 5044* (A, G, MO, P, S, UC, W); Sierra de Amambay, *Hassler 10696* (G, P, W); Cerro Torín, *Meyer 18.541* (MO).

27. RAUVOLFIA STEYERMARKII Woodson, in Fieldiana: Bot. 28³:502. 1953. (T.: *Steyermark 57428*!)

Shrubs about 6 m. tall; branches verticillate, terete, glabrous, profusely lenticellate, the nodes with distinct pectinate glands confined to the leaf-axils. LEAVES in whorls of 3 to 5, scarcely anisophyllous, shortly petiolate, elliptic to obovate-elliptic, shortly acuminate, obtuse at the base, 5–10 cm. long, 3–4 cm. broad, subcoriaceous, the secondary veins many, 4–5 mm. apart, slightly arcuate, equally evident on both surfaces; petioles stout, 5–10 mm. long. INFLORESCENCES terminal, 3- or 4-nate, much branched, many-flowered; peduncles stout, 4–5 cm. long, glabrous, bracteate, the bracts ovate, acute, about 1 mm. long, the pedicels stout, 3–5 mm. long, glabrous. FLOWERS relatively small; calyx deeply 5-lobed,

the lobes oblong-ovate, obtuse, about 2 mm. long, corolla salverform, greenish-white, fragrant (*fide* Steyermark), the tube slender, 5–6 mm. long, about 1 mm. in diameter at the base, glabrous without, villous within near the throat and the stamens, the lobes oblique-ovate, rounded, about 2.0–2.5 mm. long, about 1.5 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, about 1 mm. long, the filament about 1 mm. long; ovary 2-carpellary, apocarpous, obovate, about 2 mm. high, 1.5 mm. in diameter, the ovules 2 in each locule on a ventral placenta, the disc annular, about 1 mm. high, the style columnar, 2.5–3.0 mm. long, glabrous, the stigma-head subcapitate, about 1 mm. high, obscurely bilobed. FRUITS not known.

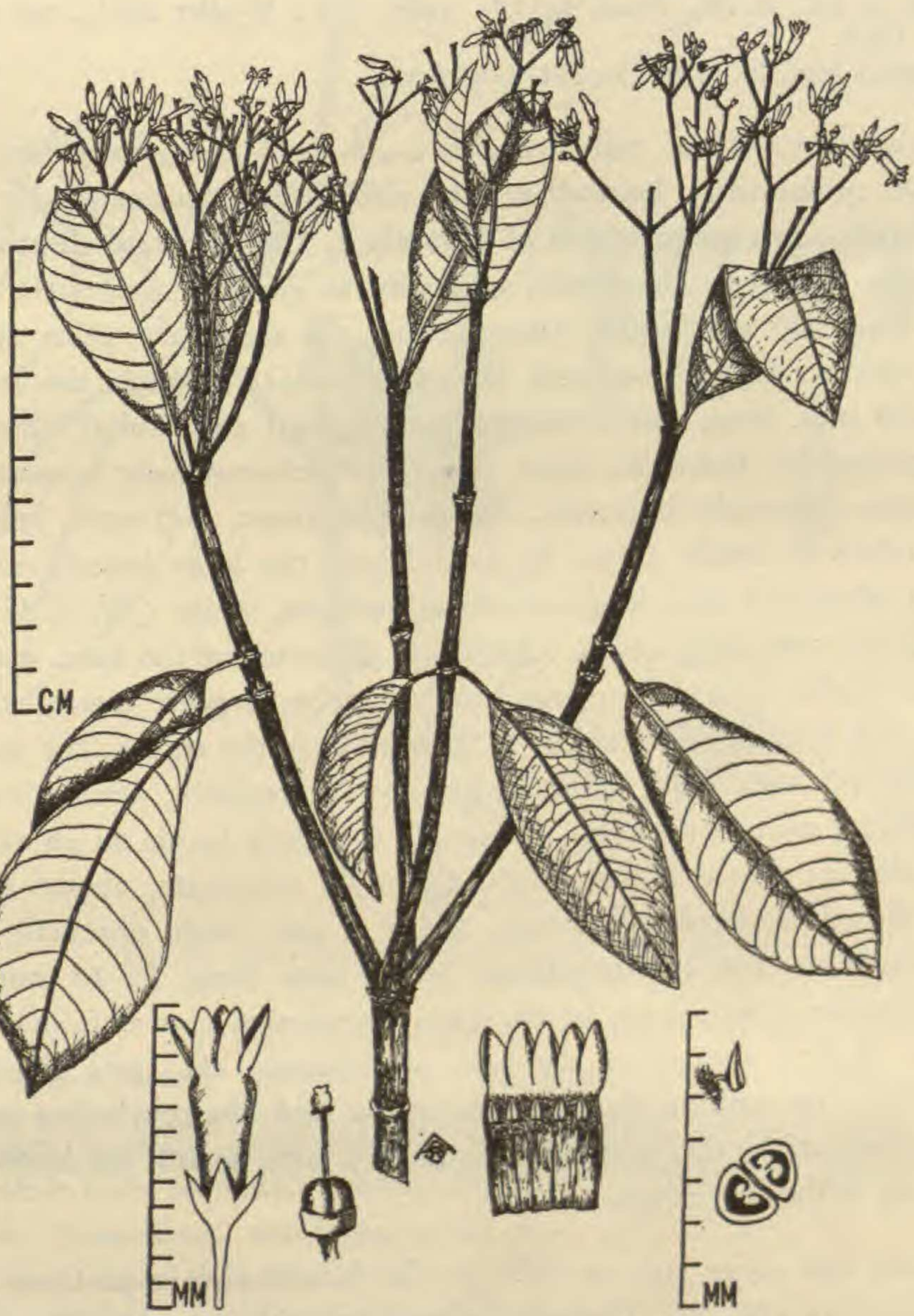

Fig. 26. *Rauvolfia steyermarkii* Woodson *(Steyermark 57428)*

Along river banks, at altitudes between 1820 and 2130 meters; flowering in July. Venezuela.

Rauvolfia steyermarkii is easily distinguished by its verticillate branches, bearing at their tips the ternate or quaternate, profusely flowered inflorescences.

VENEZUELA. TACHIRA: between Tabor and Villapaez, along Río Tachira, by Colombian-Venezuelan boundary, *Steyermark 57428* (F, MO).

28. RAUVOLFIA NITIDA Jacq. Enum. Pl. Carrib. 14. 1760; Select. Stirp. Amer. 47. 1763, *ex char.*, not *R. nitida* Lamarck, 1819.

R. angustifolia Salisb. Prodr. 146. 1796, *nom nud.*
R. nitidissima Steud. Nom. Bot. ed. 1. 682. 1821, *nom. nud.*
R. canescens Descourt. Fl. Ant. 3:151. 1827, *ex char. et icon.*, not *R. canescens* L. 1762.
R. lanceolata A. DC. in DC. Prodr. 8:337. 1844. (T.: *Wydler 290*!), not *R. lanceolata* Griseb. 1864.
R. nitida Sessé & Moc. Fl. Mex. 53. 1887, *ex char.*

Shrubs or trees 2–15 m. tall; branches 2-, 3- or 4-chotomous, terete, the bark coarse, gray, prominently lenticellate, the nodes with pectinate glands confined to the leaf-axils. LEAVES in whorls of 4, rarely 2, 3, or 5, ovate-elliptic to oblong-elliptic, acute to shortly acuminate, gradually to abruptly attenuate at the base, 3–15 cm. long, 2–5 cm. broad, subcoriaceous, the secondary veins many, almost transverse, distinct on both surfaces, the upper surface lustrous, the lower opaque; petioles 5–10 mm. long. INFLORESCENCES terminal and lateral, few- to many-flowered, corymbose; peduncles stout, repeatedly dichotomously branched, 1–4 cm. long, glabrous, minutely bracteate, the pedicels stout, 2–5 mm. long, glabrous. FLOWERS relatively small; calyx deeply 5-lobed, the lobes broadly ovate, obtuse to rounded, about 1.5 mm. long; corolla salverform, white (*fide* J. G. Jack), the tube stout, 5–6 mm. long, about 1.5 mm. in diameter at the base, glabrous without, villous within along the upper half, the lobes broadly ovate, rounded, 3–4 mm. long, 2–3 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, about 1.5 mm. long, subsessile; ovary 2-carpellary, hemisyncarpous, subglobose, about 2 mm. in diameter, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style columnar, about 3 mm. long, glabrous, the stigma-head subcapitate, about 1 mm. high, obscurely biapiculate. FRUITS subglobose, faintly emarginate, 10–12 mm. long, 15–18 mm. broad, 2-seeded, the stones ovoid, stout at the base, compressed above, faintly ridged, the seed ovate, slightly curved at the base, albuminous, the testa chartaceous, the albumen fleshy, the embryo about as long as the seed, the cotyledons ovate, obtuse, slightly curved at the tip, about 4 mm. long, 2 mm. broad, the hypocotyl terete, about as long as the cotyledons.

On sandy and stony soil, on hills, in the forests and in pastures, at altitudes from sea-level to 600 m. Flowering from September to March; ripe fruits in March and April. The West Indies.

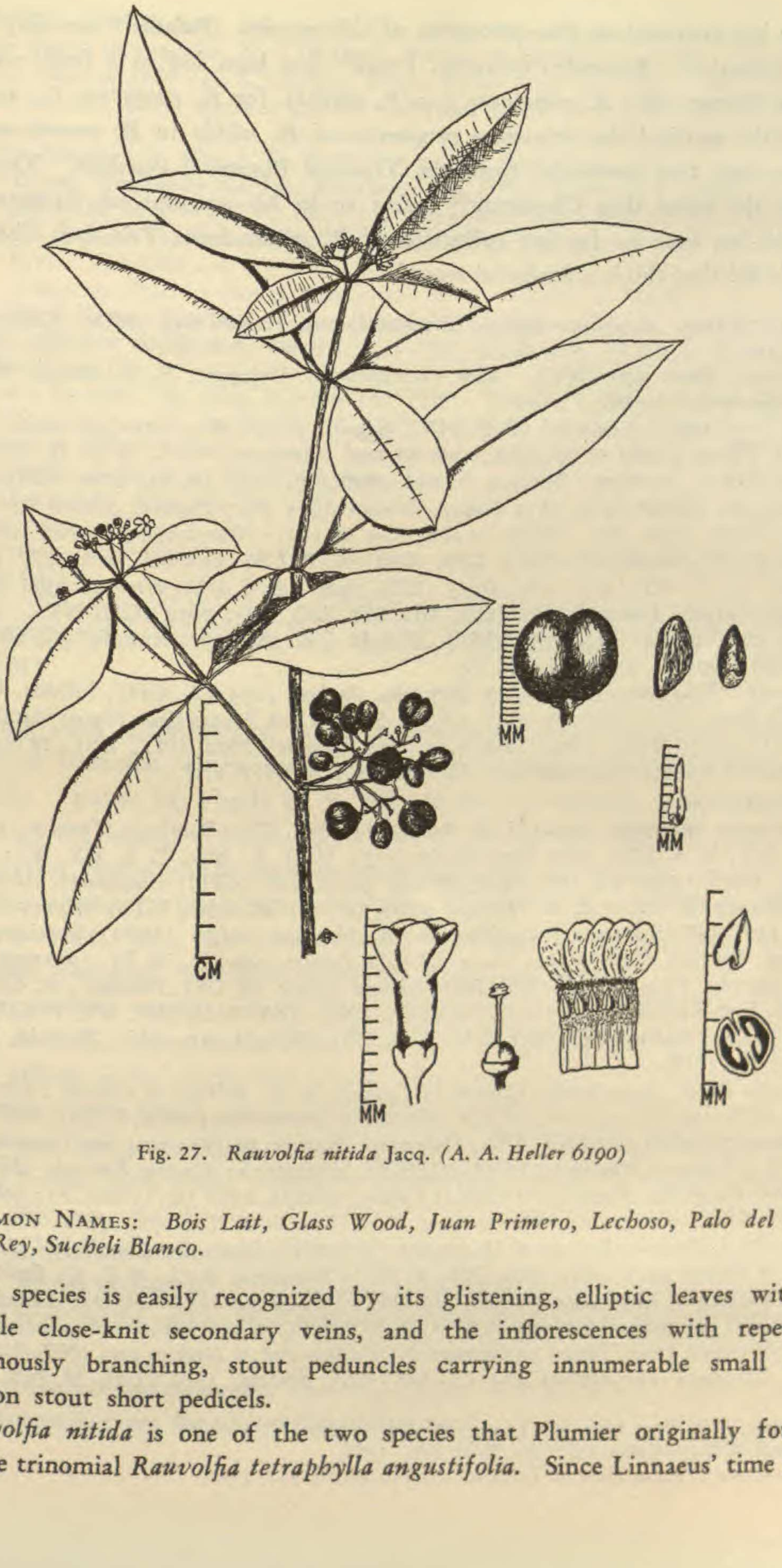

Fig. 27. *Rauvolfia nitida* Jacq. *(A. A. Heller 6190)*

Common Names: *Bois Lait, Glass Wood, Juan Primero, Lechoso, Palo del Leche, Palo del Rey, Sucheli Blanco.*

This species is easily recognized by its glistening, elliptic leaves with innumerable close-knit secondary veins, and the inflorescences with repeatedly dichotomously branching, stout peduncles carrying innumerable small white flowers on stout short pedicels.

Rauvolfia nitida is one of the two species that Plumier originally founded under the trinomial *Rauvolfia tetraphylla angustifolia.* Since Linnaeus' time much

confusion has occurred on the synonymy of this species. Rendle[50] has ably clarified this situation. Recently, however, Feuell[51] has been led to a fresh error in mistaking Descourtilz's *R. canescens* (= *R. nitida*) for *R. canescens* L., and has consequently ascribed the poisonous properties of *R. nitida* to *R. canescens*.

I have seen two specimens from the Trinidad Botanical Gardens. These are obviously the same that Cheesman[52] refers to in his account of Apocynaceae. Since there has been no further collection of *R. nitida* from Trinidad, Cheesman has concluded that this is a doubtful record.

UNITED STATES. FLORIDA: Miami, Coconut Grove, *Fennell 651* (MO) (Cultivated).
ANTILLES.—
BAHAMAS: *Brace 346* (NY). NEW PROVIDENCE: Delaport, *N. L. Britton & Brace 306* (A, GH, MO, NY, US).
CUBA. HAVANA: *Leon 660, 3696* (NY), *Sagra s. n.* (P, W). ISLE OF PINES: *N. L. Britton & Wilson 14864* (NY, US). MATANZAS: Matanzas, *N. L. & E. G. Britton & Shafer 96* (NY). ORIENTE: Baraçoa, *Ekman 4440* (S), *5145* (P, S), *Leon 11863, 12143* (NY); Bayate, *Ekman 6112* (S); Cupey, *Ekman 6325* (S); Papayo, *Ekman 9324* (S); Manacal, *Ekman 9390* (S). SANTA CLARA (LAS VILLAS): Cienfuegos, *Combs 296* (GH, MO, NY, P, US), *Jack 5089* (A, S, US), *5154* (A, P, US); Soledad, *Jack 4977* (A, P), *5427, 5685* (A, P, US), *5653* (A), *6735* (US), *7426* (A, S, US), *Howard 6591* (GH, S, US); Mina Carlota, *Howard 5631* (GH, MO, NY, UC, US), *5694* (GH, NY). PRECISE LOCALITY UNKNOWN: *Rugel 751* (NY), *Wright s. n.* (S), *397 = 1384* (G, GH, MO, NY, P, US), *400* (S), *1383* (G, GH, P).
JAMAICA. Blue Mountains, below Berurcks, *Parkins 1195* (A, GH), hillside, Potsdam to Lover's Leap, *N. L. Britton 1131* (NY), Santa Cruz Mountains, *Harris 5402* (US), *5850* (NY), *9743* (NY, US); Tepe near Troy, *Harris 11071* (NY, US), *11113* (NY, US). PRECISE LOCALITY UNKNOWN: *Alexander s. n.* (GH, NY, P).
HISPANIOLA.—
DOMINICAN REPUBLIC: Azua, *J. N. Rose 4054* (NY, US); Barahona, *Fuertes 318* (GH, L, MO, NY, P, S, US), *Von Tuerckheim 2831* (GH, L, MO, P, S, US, W); Ciudad Trujillo, *Allard 14627* (S, US), *Schiffino 126* (US), *160* (GH); Constanza, *Abbott s. n.* (US); Higuey, *R. A. & E. S. Howard 9760, 9770* (GH, MO, NY), Higuey to Gato, *Taylor 449* (NY); Puerto Escondido, *R. A. Howard 12140* (MO); Santiago de los Caballeros, *Jimenez 2706* (MO); Sierra del Pala, *Eggers 1900* (L, M, P). PRECISE LOCALITY UNKNOWN: *Eggers 2518* (NY, US), *Ekman 14294* (S, US), *Poiteau s. n.* (P), *Sagra s. n.* (P), *Von Tuerckheim 2692* (M, NY, P), *3485* (GH, L, M, MO, NY, P, S, US, W), *1385bis* (GH), *Valeur 678* (MO, NY, P, S, US), *Wright 219* (US), *Wright, Perry & Brummel 407* (US).
PUERTO RICO. HUMACAO: Coamo to Caguas, *N. L. Britton & Cowell 1380* (NY); vicinity of Coamo Springs, *N. L. & E. G. Britton & Brown 6424* (NY, P, US), *6481* (NY), *Underwood & Griggs 460* (NY, US); Humacao, *Blanner 50* (P); near San Germán, *Miller 1626* (US); Yabucoa, *Sintenis 5036* (G, M, P, S). AGUADILLA: Rincon, *Sintenis 5680* (L, P). GUAYAMA: Guayama, *Kuntze 511* (NY); Cayey, *Sintenis 2372* (G, L, MO, P); Jobos, *Goll 517, 518* (US). MAYAGUEZ: Monte Mesa, *N. L. Britton & Hess 2716* (NY, US); Río de Maricao, *N. L. Britton, Stevens & Hess 2421* (NY, US); Punta Guaniquilla, *N. L. Britton, Cowell & Brown 4571* (GH, MO, NY, P, US); Parquera, *N. L. & E. G. Britton 9926* (NY); vicinity of Mayaguez, *Cowell 695* (NY, US), *Fogg 21770* (MO); Yauco, *Garber 42* (GH, NY); Guanica, *Sintenis 3372* (GH, NY, US), *3835* (NY, P, US); Lajas, *Sargent 522* (US); road from Yauco to Guayanilla, *Underwood & Griggs 599* (NY, US). SAN JUAN: Bayamon, *The Hellers 403* (A, NY, US), *Sintenis 1193* (GH, M, NY, S, US),

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[50] Rendle, A. B., Proc. Linn. Soc. Lond. 149[3]:106. 1937.
[51] Feuell, A. J., in Colon. Pl. & An. Prod. 5:5. 1955.
[52] Cheesman, E. E., in Flora of Trinidad and Tobago 2[3]:153. 1947.

1194bis (G); Martin Pena, *Stevenson 1872* (US), Point Cangrejos, *Stevenson 522* (US). PONCE: Ponce to Penuelas, *N. L. & E. G. Britton & Marble 1753* (GH, MO, NY, US); Penuelas, *Sintenis 4786* (M, S, US, W); Ponce, *Heller 6190* (A, GH, L, MO, NY, P, US). VIEQUES ISLAND: Santa Maria to Caballo Colorado, *Shafer 2680, 2684* (NY, US). MONA ISLAND: *Stevens 6318* (NY). PRECISE LOCALITY UNKNOWN: *Wydler 290* (G, L), *Plée s. n.* (P), *Poiteau s. n.* (P), *L. C. Richard s. n.* (P), *Riedel s. n.* (P).

ST. CROIX: Prosperity Garden, *Raunkiaer s. n.* (US), *Benzon s. n.* (MO), *A. E. Ricksecker 362* (GH, MO, NY, UC, US), *J. J. Ricksecker 428* (MO, P, US); Fredericksted, *J. N. Rose 3515* (NY), *Thompson 98* (GH, NY), *803, 876* (S).

ST. KITTS: *Fairchild s. n.* (A, MO, US).

ST. THOMAS: Pearl to Bonne Resolution, *E. G. Britton & Marble 1325* (MO, NY, US); near Solbjerg, *Eggers s. n.* (S); Signal Hills, *Eggers 385* (G, L, M, P, US, W). PRECISE LOCALITY UNKNOWN: *Bertero s. n.* (M), *Krebs s. n.* (NY), *L. C. Richard s. n.* (P), *Riedel s. n.* (P).

VIRGIN ISLANDS: St. John, *Morrow 167* (US); Tortola, Belmont sand dunes, *Fishlock 430* (NY), *Shafer 1156, 1178* (NY, US), *N. L. & E. G. Britton & Kemp 89* (NY).

ANTILLES (WEST INDIES): precise locality unknown, *Swartz s. n.* (S), *Sessé & Moçino 675, 1449* (F), *Ridley s. n.* (P), *Vahl 5209* (L).

GUADELOUPE: *Alleizette s. n.* (L).

MARTINIQUE: *Plée s. n.* (P).

TRINIDAD: *Trinidad Botanic Garden Herb. 1931* (US); woods of Chaguanas, *Prestoe 1448* (NY).

29. RAUVOLFIA BAHIENSIS A. DC. in DC. Prodr. 8:339. 1844. (T.: *Blanchet 3186*!)

Plants with trichotomous, rarely dichotomous, terete, glabrous, prominently lenticellate branches, the nodes with distinct pectinate glands confined to the leaf-axils. LEAVES in whorls of 3, oblanceolate to obovate, shortly acuminate, cuneate at the base, 3–12 cm. long, 1.0–4.5 cm. broad, subcoriaceous, the secondary veins barely visible on both surfaces; petioles 5–10 mm. long. INFLORESCENCES terminal, geminate or ternate, few-flowered, umbellate; peduncles slender, 3–4 cm. long, glabrous, minutely bracteate, the pedicels slender, 10–15 mm. long, glabrous. FLOWERS relatively small; calyx deeply 5-lobed, the lobes ovate to deltoid, acute, about 2 mm. long; corolla infundibuliform, the tube slender, 6–7 mm. long, about 2 mm. in diameter at the base, glabrous without, densely villous nearly to the base within, the lobes ovate, broadly acute, 4–5 mm. long, about 2 mm. broad; stamens 5, inserted near the throat, the anthers subulate, about 2 mm. long, subsessile; ovary 2-carpellary, free nearly to the base, obovoid, about 2.5 mm. high, about 2 mm. in diameter, the ovules 2 in each locule on a ventral placenta, the disc annular, about 1 mm. high, the style columnar, 3–4 mm. long, glabrous, the stigma-head subcapitate, about 1 mm. high, obscurely bilobed. Fruits unknown.

Near river banks and on road-sides; flowering during December. Eastern Brazil.

The densely lenticellate, trichotomous, terete twigs, with the terminal, prominently umbellate inflorescences carrying long-pedicelled flowers, serve to distinguish this species from the related Rauvolfias.

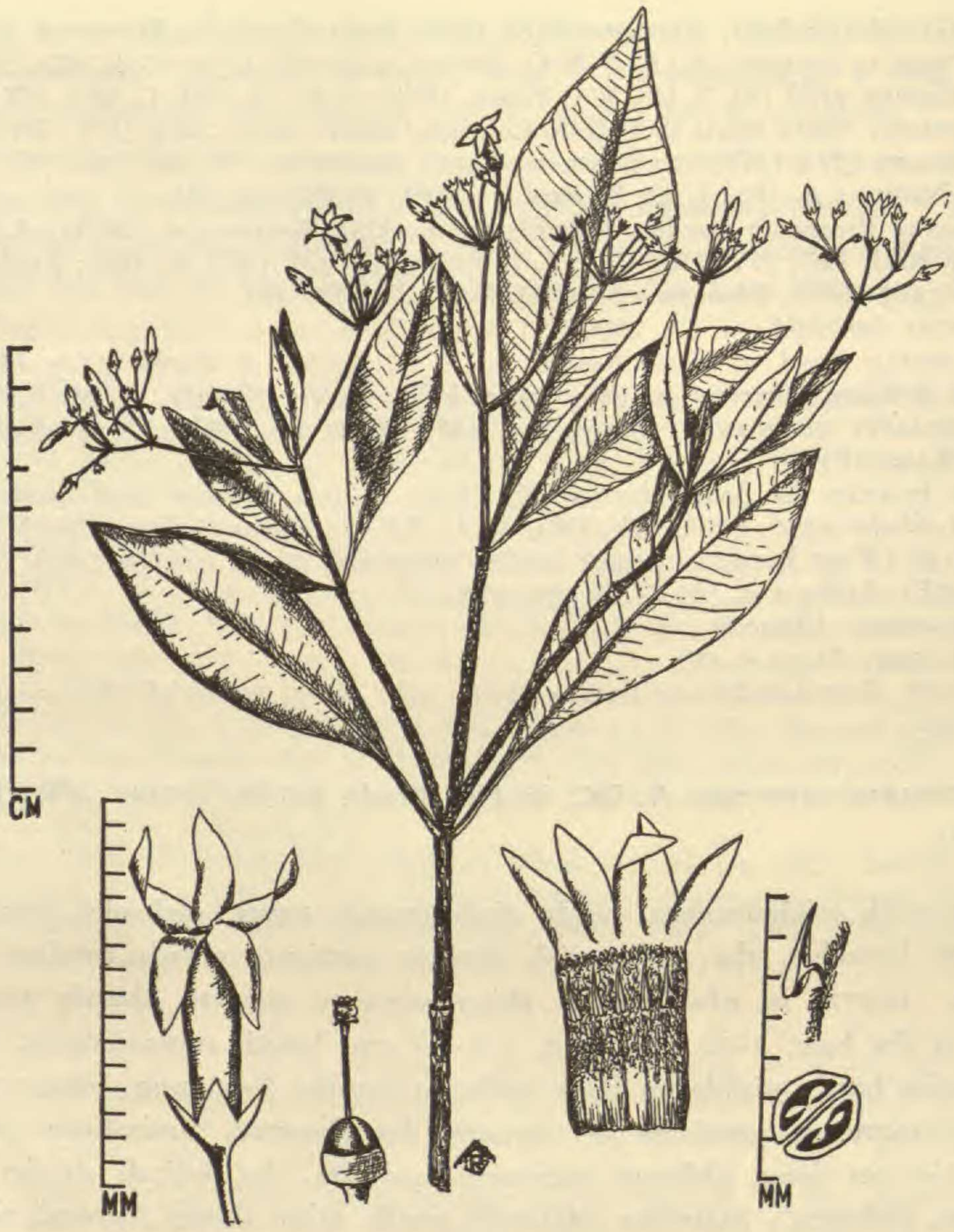

Fig. 28. *Rauvolfia bahiensis* A. DC. *(Blanchet 3186)*

BRAZIL. BAHIA: basin of Rio Santa Ana, road to Pontal, *Krukoff 12698/63* (NY); precise locality not known, *Blanchet 3186* (G, W); *Riedel s. n.* (G, GH, P, W).

30. RAUVOLFIA BIAURICULATA Muell.-Arg. in Linnaea 30:396. 1860. (T.: *Sieber s. n.* !)

Shrubs or trees 3–9 m. tall; branches 2- or 3-chotomous, terete, glabrous, the bark gray, wrinkled longitudinally, slightly lenticellate, the nodes with distinct pectinate glands in the leaf-axils only. LEAVES in whorls of 3, rarely 4, shortly petiolate, oblanceolate to obovate, shortly acuminate to caudate, cuneate at the base, 5–12 cm. long, 2.0–3.5 cm. broad, coriaceous, the secondary veins obscure on both surfaces, the two surfaces opaque; petioles 5–10 mm. long. INFLORESCENCES terminal, few-to many-flowered, corymbose; peduncles repeatedly 2-branched,

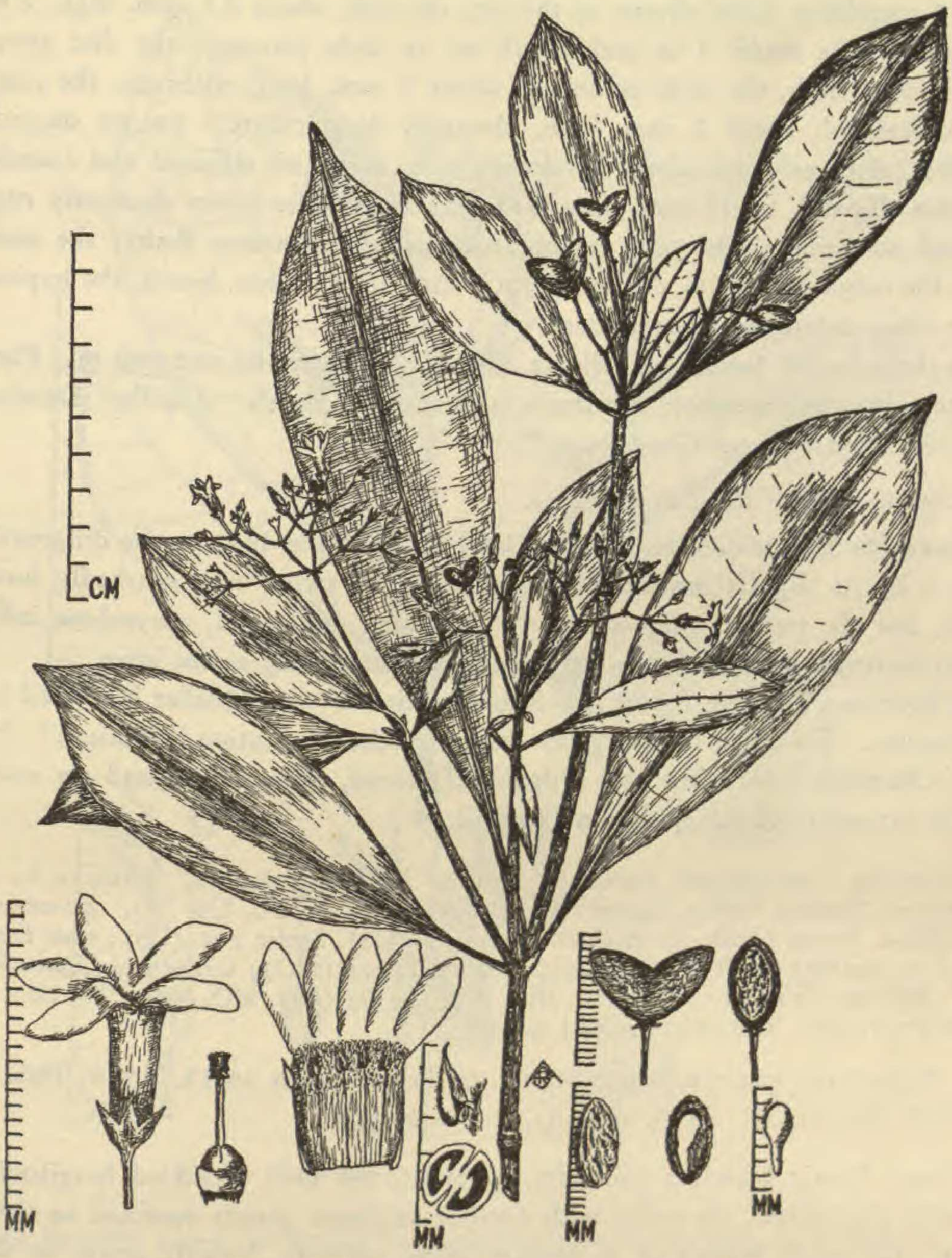

Fig. 29. *Rauvolfia biauriculata* Muell.-Arg. *(Eggers 674)*

slender, 3–5 cm. long, glabrous, minutely bracteate, the pedicels slender, 5–10 mm. long, glabrous. FLOWERS relatively small; calyx deeply 5-lobed, the lobes deltoid, acute, about 1.5 mm. long, the margin minutely glandular-dentate; corolla salverform, roseate (*fide* Howard), the tube slender, 4–6 mm. long, about 1 mm. in diameter at the base, glabrous without, villous within along the upper half, the lobes obliquely oblong-elliptic, obtuse, 4–5 mm. long, 2–3 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acuminate, about 2 mm. long, subsessile;

ovary 2-carpellary, fused almost to the top, obovoid, about 2.5 mm. high, 2 mm. in diameter, the ovules 1 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style columnar, about 3 mm. long, glabrous, the stigma-head cylindrical, about 1 mm. high, obscurely bi-apiculate. FRUITS obcordate, 2-seeded (often only one carpel developing, then the fruit ellipsoid and 1-seeded), the lobes ellipsoid, 12–15 mm. long, 5–8 mm. broad, the stones distinctly rugose, the seed albuminous, the testa membranaceous, the albumen fleshy, the embryo erect, the cotyledons ovate, obtuse, about 3 mm. long, 2 mm. broad, the hypocotyl terete, about as long as the cotyledons.

In dense humid forests, on hills, at altitudes between 500 and 800 m. Flowering from June to December; ripe fruits in January to March. Antilles: Dominican Republic, Dominica, and Guadeloupe.

COMMON NAME: *Bois Lait-montagne.*

Rauvolfia biauriculata resembles greatly *R. bahiensis*, but can be differentiated from it by its slightly lenticellate, wrinkle-barked twigs with markedly leathery leaves, and the terminal dichotomously branching peduncled, corymbose inflorescences bearing flowers with the corolla-tube almost as long as the lobes.

I have seen the two Ritter and Sieber specimens that Mueller has cited in his description. The Sieber sheet carries distinctly the annotation "Trinitas." However, Cheesman[53] considers this a doubtful record, as he has found no evidence for the occurence of this species in Trinidad.

ANTILLES. DOMINICAN REPUBLIC: precise locality unknown, *Ritter s. n.* (W). DOMINICA: Pleasant Valley, *Eggers 674* (G, GH, L, M, P, UC, US, W). GUADELOUPE: Fort Baines Jaunes, *Stehle, Quentin et Bena 5601* (US), *Stehle 702* (US); trail from St. Cloud to Soufrière above Baines Jaunes, *Howard 11794* (MO); Grand Bois, *Quentin 726* (P). PRECISE LOCALITY UNKNOWN: *Duss 8* (P), *2544* (GH, MO, NY, UPS, US), *L. C. Richard s. n.* (P). TRINIDAD: *Sieber s. n.* (W).

31. RAUVOLFIA PURPURASCENS Standl. in Trop. Woods 16:11. 1928; Field Mus. Publ. Bot. 4:255. 1929. (T.: *G. P. Cooper 516!*)

Stout liana?; branches subterete, glabrous, the bark wrinkled longitudinally, scarcely lenticellate, the nodes with distinct pectinate glands confined to the leaf-axils. LEAVES in whorls of 4, long-petiolate, obovate, broadly acute to shortly acuminate or obtuse, cuneate at the base, 5–16 cm. long, 3–7 cm. broad, membranaceous to coriaceous, the secondary veins several, arcuate, joining at the margins to form marginal veins, distinct on both surfaces, the two surfaces opaque; petioles stout, 12–20 mm. long. INFLORESCENCES terminal, lax, few- to many-flowered, paniculate; peduncles slender, 3–6 cm. long, glabrous, minutely bracteate, the pedicels slender, 3–6 mm. long, glabrous. FLOWERS relatively small; calyx deeply 5-lobed, the lobes ovate, acute, about 2 mm. long; corolla salverform, purpurascent (*fide* G. P. Cooper), the tube slender, 6–7 mm. long, about 1 mm. in diameter at the base, glabrous without, villous within near the throat and the stamens, the lobes

[53] Cheesman, E. E., in Flora of Trinidad and Tobago 2^3:153. 1947.

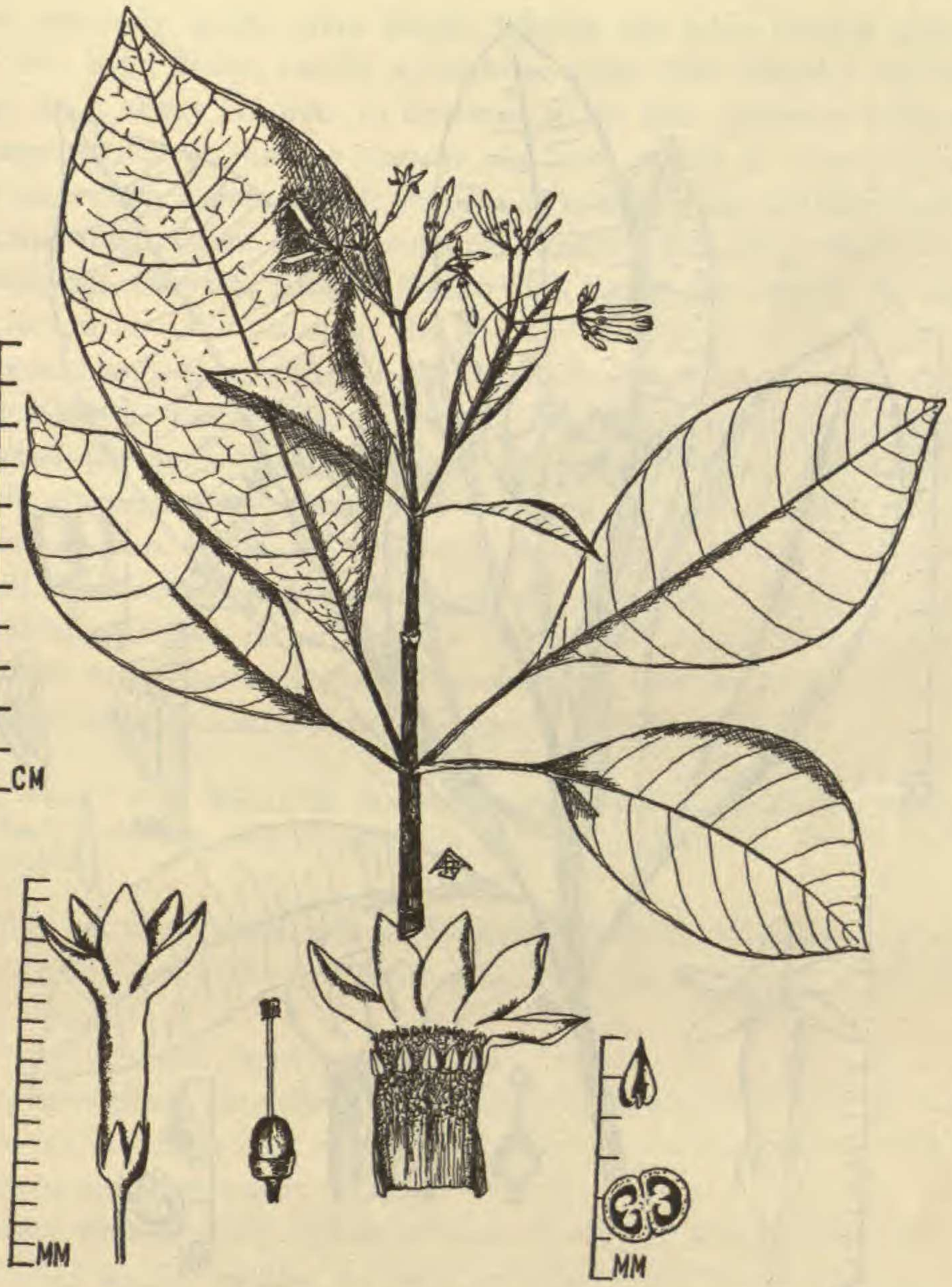

Fig. 30. *Rauvolfia purpurascens* Standl. *(Cooper 516)*

obovate, broadly acute to obtuse, 5–6 mm. long, 2–3 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, about 1.5 mm. long, subsessile; ovary 2-carpellary, hemisyncarpous, cylindrical, about 3 mm. high, 2 mm. in diameter, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style columnar, 3–4 mm. long, the stigma-head subcapitate, about 1 mm. high, obscurely bi-apiculate. FRUITS unknown.

Flowering from January to March. Panama: Cricamola Valley. The branches bearing whorls of 4 long-petioled, obovate leaves with distinct, arcuate secondary veins, and the terminal, loose, paniculate inflorescences distinguish *R. purpurascens* from the related species of *Rauvolfia*.

PANAMA. BOCAS DEL TORO: region of Almirante, Cricamola Valley, *Cooper 516* (F, G, US).

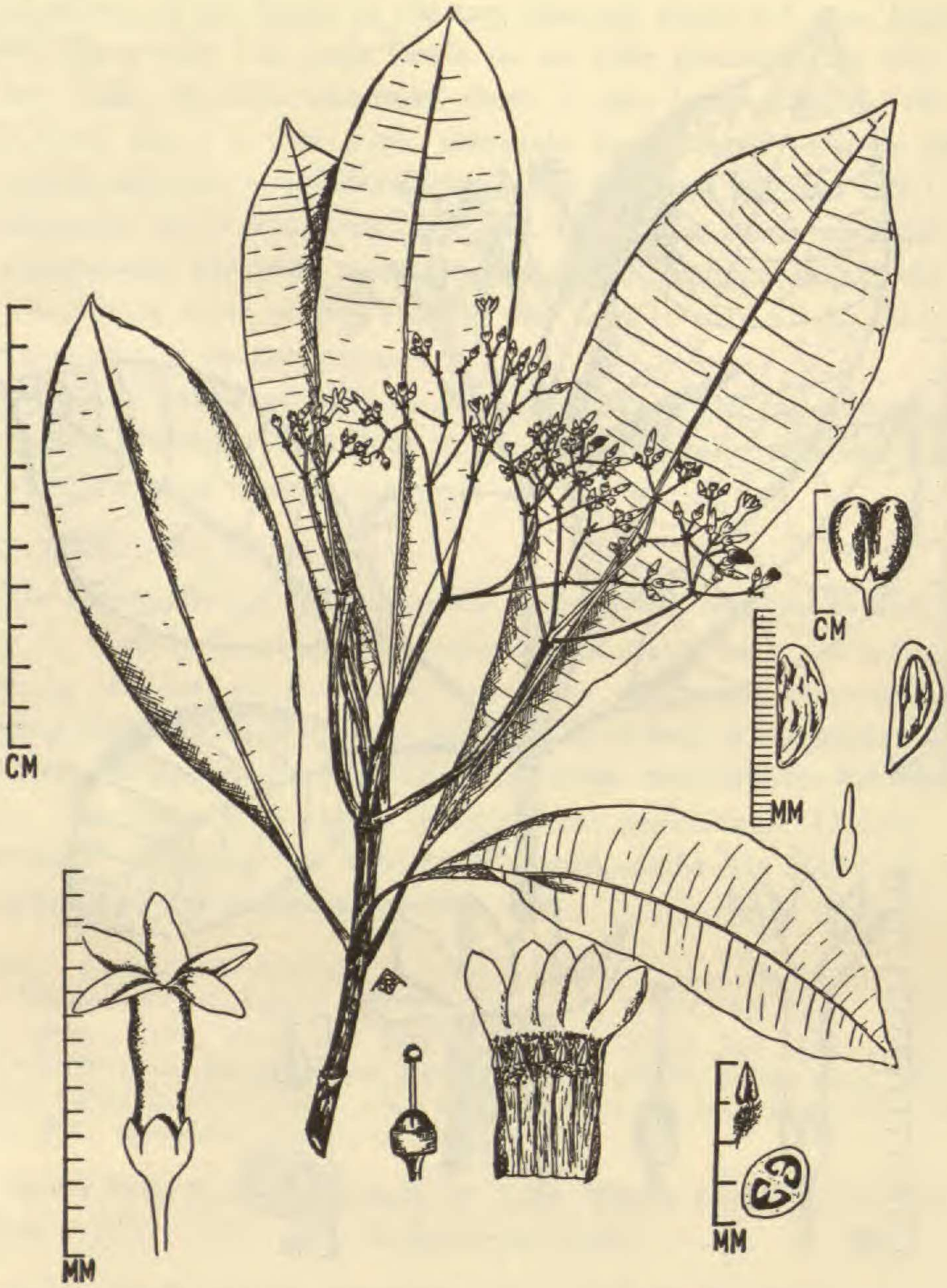

Fig. 31. *Rauvolfia sarapiquensis* Woodson *(Skutch 3556,* and *Mora s. n.)*

32. RAUVOLFIA SARAPIQUENSIS Woodson, in Ann. Mo. Bot. Gard. 28:271. 1941. (T.: *Skutch 3556*!)

Trees about 15 m. tall; branches terete to subangular, the bark dark gray, glabrous, the nodes with distinct pectinate glands confined to the leaf-axils. LEAVES in whorls of 3, long-petiolate, oblong-oblanceolate to oblong-elliptic, shortly acuminate, attenuate at the base, 15–25 cm. long, 4–7 cm. broad, coriaceous, the secondary veins several, almost transverse, equally evident on both surfaces, the two surfaces opaque; petioles stout, 1.5–2.5 cm. long. INFLORESCENCES terminal, ternate, many-flowered, corymbose; peduncles stout, 5–6 cm. long, 2- or 3-branched, glabrous, minutely bracteate, the pedicels stout, 4–5 mm. long, glabrous.

FLOWERS relatively small; calyx deeply 5-lobed, the lobes broadly ovate, obtuse, about 2 mm. long, fleshy; corolla salverform, white (*fide* Skutch), the tube stout, 5–7 mm. long, about 1.5 mm. in diameter at the base, glabrous without, villous within near the throat and the stamens, the lobes elliptic to ovate-elliptic, obtuse, about 4 mm. long, 2 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, about 1 mm. long, the filament about 1 mm. long; ovary 2-carpellary, hemisyncarpous, obovoid, about 2.5 mm. high and 2 mm. broad, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style linear, about 2 mm. long, glabrous, the stigma-head subglobose, about 1 mm. high, obscurely bilobed. FRUITS slightly bilobed, the lobes obovate, about 18 mm. high, 8 mm. broad, the stones distinctly rugose, the seed albuminous, the testa membranaceous, the albumen fleshy, the embryo erect, the cotyledons oblong, obtuse, about 5 mm. long, 2 mm. broad, the hypocotyl terete, about as long as the cotyledons.

On hill slopes at altitudes of about 1500 m.; flowering in February. Costa Rica.

The oblong-elliptic, rather leathery leaves with almost transverse secondary veins, and the many-flowered, much-branched inflorescences distinguish this species from the rest of the Central American species of *Rauvolfia*.

COSTA RICA. Vara Blanca de Sarapiqui, north slope of central Cordillera, between Poas and Barba volcanoes, *Skutch 3556* (A, MO, US); Buena Vista de San Carlos, *H. B. Mora s. n.* (MO).

33. RAUVOLFIA PRAECOX K. Sch. ex Markgraf, in Fedde, Rep. Spec. Nov. 20:119. 1924. (T.: *Ule 6256*!); ex Ule in Engl. Bot. Jahrb. 40:400. 1908, *nom nud.*

Trees 15–30 m. tall; branches subangular to terete, 2-, 3- or 4-chotomous, the bark gray, lenticellate, the nodes with distinct pectinate glands confined to the leaf-axils. LEAVES in whorls of 3 or 4, long-petiolate, narrowly elliptic, acute or acuminate to obtuse, attenuate at the base, 5–15 cm. long, 2–5 cm. broad, coriaceous, the secondary veins several, slightly arcuate, meeting at the margins to form two marginal veins equally evident on both surfaces, the upper surface lustrous, the lower opaque; petioles slender, 2–3 cm. long. INFLORESCENCES terminal, often at the tips of defoliated twigs, many-flowered, paniculate; peduncles ternate, 2- or 3-branched, 2–4 cm. long, glabrous, minutely bracteate, the pedicels slender, 6–9 mm. long, glabrous. FLOWERS relatively small; calyx deeply 5-lobed, the lobes ovate, acuminate, about 1 mm. long; corolla salverform, reddish-violet (*fide* Ule), the tube slender, 5–7 mm. long, about 1 mm. in diameter at the base, glabrous without, scantily pilose within near the throat and the stamens, the lobes ovate, broadly acute to obtuse, 4–6 mm. long, about 2 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acuminate, about 1 mm. long, subsessile; ovary 2-carpellary, hemisyncarpous, obovoid, about 2 mm. high, 1.5 mm. broad, the ovules 2 in each locule on an axile placenta, the disc annular, about 1 mm. high, the style linear, 3–5 mm. long, glabrous, the stigma-head cylindrical, about 1 mm. high, obscurely bilobed. FRUITS not seen.

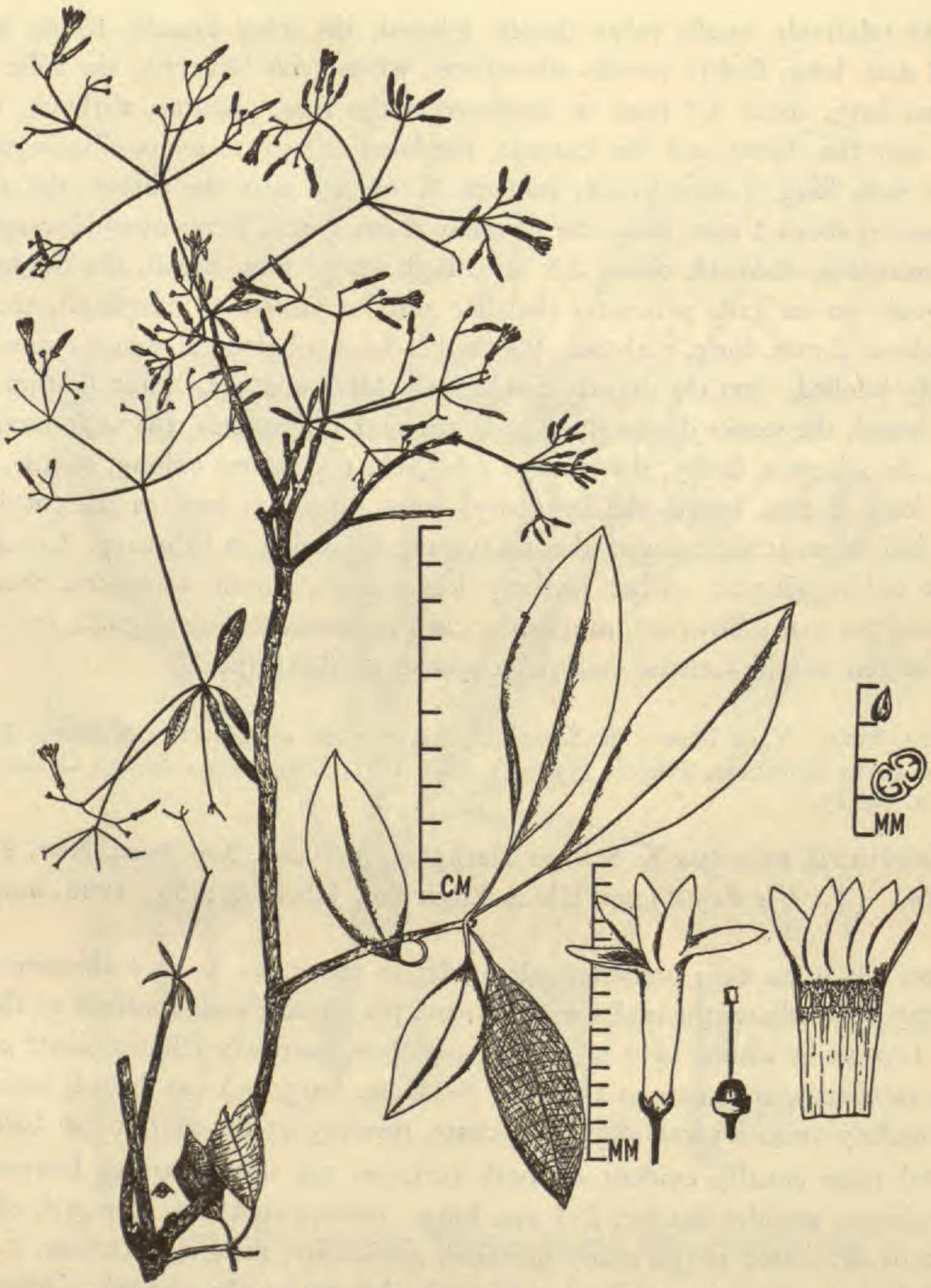

Fig. 32. *Rauvolfia praecox* K. Sch. *(Ule 6256)*

On river banks in dense forests; flowering from July to October. Bolivia, Peru and Western Brazil.

Common Name: Bolivia—*Amargo.*

Rauvolfia praecox has been confused in the past with *R. sellowii,* which is eastern Brazilian in its distribution. It can be distinguished by its long-petioled, glistening, elliptic leaves and the terminal inflorescences with a profusion of reddish-violet, slender flowers.

BRAZIL. AMAZONAS: near mouth of Rio Embira, tributary of Rio Taracua, lat 7.30° s., long. 70.15° w., *Krukoff 5018* (A, F, G, M, MO, P, S, US).

BOLIVIA. SANTA CRUZ: Sara, Buena Vista, banks of Río Surutu, *Steinbach 6536* (A, F, M, MO, S, US), *6561* (F, G, MO, S, UC, W).

PERU. LORETO: Iquitos, *Ule 6256* (G, L).

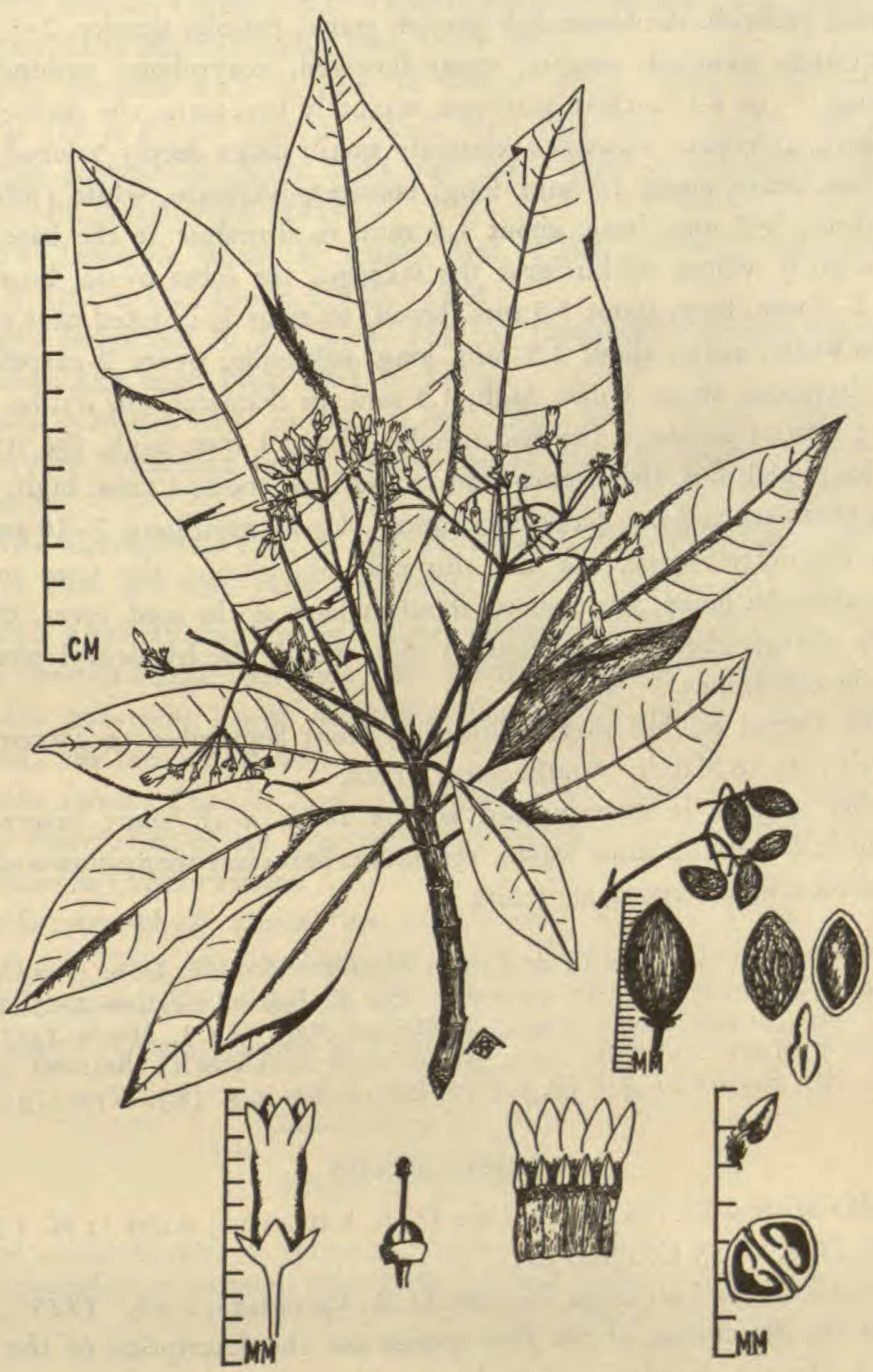

Fig. 33. *Rauvolfia sellowii* Muell.-Arg. *(Weir 173)*

34. RAUVOLFIA SELLOWII Muell.-Arg. in Mart. Fl. Bras. 6[1]:34. 1860. (T.: *Sellow 238*)

Trees with branches verticillate, terete, the bark gray, longitudinally wrinkled, the internodes short, the nodes with distinct pectinate glands confined to the leaf-axils. LEAVES in whorls of 4, long-petiolate, oblong-obovate to oblong-elliptic, obtuse-acuminate, attenuate at the base, 6–20 cm. long, 3–6 cm. broad, membranaceous, the secondary veins several, arcuate, equally evident on both surfaces, the upper surface greenish, the lower dull grayish green; petioles slender, 2–3 cm. long. INFLORESCENCES terminal, ternate, many-flowered, corymbose; peduncles stout, 3–5 cm. long, 3- or 4-branched, glabrous, minutely bracteate, the pedicels slender, 3–5 mm. long, glabrous. FLOWERS relatively small; calyx deeply 5-lobed, the lobes broadly ovate, acute, about 1.5 mm. long; corolla salverform, white (*fide* Sellow), the tube stout, 5–7 mm. long, about 1.5 mm. in diameter at the base, glabrous without, scantily villous within near the stamens, the lobes ovate, broadly acute to obtuse, 2–3 mm. long, about 1.5 mm. broad; stamens 5, inserted near the throat, the anthers ovate, acute, about 1.5 mm. long, subsessile; ovary 2-carpellary, apocarpous, subglobose, about 2 mm. high, 1.5 mm. in diameter, the ovules 2 in each locule on a ventral placenta, the disc annular, about 1 mm. high, the style linear, 3–4 mm. long, glabrous, the stigma-head cylindrical, about 1 mm. high, obscurely bilobed. FRUITS apocarpous, drupelets ellipsoid, 12–16 mm. long, 7–10 mm. broad, the stones distinctly rugose, the seed ellipsoid, albuminous, the testa membranaceous, the albumen fleshy, the embryo about as long as the seed, erect, the cotyledons ovate, obtuse, about 7 mm. long, 3 mm. broad, the hypocotyl terete, about as long as the cotyledons.

In dense forests on hill slopes, flowering from September to December; ripe fruits in February to March. Southeastern Brazil.

Rauvolfia sellowii is distinguished by its twigs with short internodes, the oblong-elliptic membranaceous leaves, the much-branched many-flowered inflorescences, and the ellipsoid apocarpic fruits.

BRAZIL. MINAS GERAES: Cidade de Caldos, *Henschen 866* (F, US). PARANA: Capao Grande, *Dusén 7631* (S). RIO DE JANEIRO: Rio de Janeiro, *Glaziou 2915, 6045* (P), *1045* (K). SÃO PAULO: Monte Alegre, *Kuhlmann 7995* (UC), *Mosén 1457* (S), São Paulo, *Mello & Mosén s. n.* (S). PRECISE LOCALITY UNKNOWN: *Burchell 4678* (K), *Glaziou s. n.* (P), *Regnell 111866* (P, S, UPS, US), *Sellow s. n.* (K), *Weir 173* (K).

DUBIOUS SPECIES

Rauvolfia arborea Larrañaga, Escritos D. A. Larrañaga, Atlas 1: *pl. 132.* 1927 (Publ. Inst. Hist. Geog. Uruguay).

Rauvolfia bilabiata Larrañaga, Escritos D. A. Larrañaga, 2:85. 1923.

Neither the illustration of the first species nor the description of the second is sufficient to refer the above two to any known species.

Rauvolfia oppositiflora Sessé & Moç. in La Naturaleza, Ser. 2^1:32. 1888. The description is insufficient to refer this to any known species.

Rauvolfia rhomhofiae Mgf. in Notizblatt 15:384–385. 1941. I have not been able to examine any representative material of this species. From the original description, I am inclined to treat it as synonymous with *R. sanctorum* Woodson.

EXCLUDED SPECIES

Rauvolfia dentata Tafalla, ex D. Don, in Edinb. New Phil. Jour. 10:237. 1831 = CITHAREXYLUM DENTATUM D. Don, *l. c.* 1831.

Rauvolfia flexuosa Ruiz & Pav. Fl. Peruv. 2:26. 1799 = CITHAREXYLUM FLEXUOSUM (R. & P.) D. Don, in Edinb. New Phil. Jour. 10:237. 1831.

Rauvolfia glabra Cav. Icon. 3:50, *tab. 297*. 1794 = VALLESIA DICHOTOMA Ruiz & Pav., Fl. Peruv. 2:26. 1799.

Rauvolfia laevigata Roem. & Schult. Syst. 4:805. 1819 = MALOUETIA JASMINOIDES A. DC. in DC. Prodr. 8:379. 1844.

Rauvolfia longifolia A. DC. *l. c.* 338 = TONDUZIA LONGIFOLIA (A. DC.) Mgf. in Fedde, Rep. Spec. Nov. 20:112. 1924.

Rauvolfia lycioides Cav. in Anal. Cienc. Nat. 5:69. 1802. This is a species of *Citharexylum* according to my observation of the type specimen from the Paris Herbarium.

Rauvolfia macrophylla Ruiz & Pav. Fl. Peruv. 2:26. 1799 = CITHAREXYLUM RETUSUM D. Don, in Edinb. New Phil. Jour. 10:237. 1831.

Rauvolfia oppositifolia Spreng. Neue Entdeck. 3:33. 1822 = TABERNAEMONTANA OPPOSITIFOLIA (Spreng.) Urb. Symb. Antill. 4:493. 1910.

Rauvolfia pubescens Roem. & Schult. Syst. 4:805. 1819 = CITHAREXYLUM MOLLE Jacq., *fide* Index Kewensis.

Rauvolfia spinosa Cav. in Anal. Hist. Nat. 1:43. 1799; Icon. 6:16, *tab 526*. 1801. My observation of the type from the Madrid Herbarium indicates that this is also a species of *Citharexylum*.

Rauvolfia stenophylla Donn. Sm. in Bot. Gaz. 44:115. 1907 = TONDUZIA LONGIFOLIA (A. DC.) Mgf. in Fedde, Rep. Spec. Nov. 20:112. 1924.

Rauvolfia strempelioides Griseb. Cat. Pl. Cub. 170. 1866 = STREMPELIOPSIS STREMPELIOIDES (Griseb.) Benth. in Benth. & Hook. Gen. Pl. 2:702. 1866.

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Italicized numerals refer to collectors' numbers, *s. n. (sine numero)* to unnumbered collections; parenthetical numerals refer to the number assigned to the species conserved in this revision.

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Riedel, L. *s. n.* (12); *s. n.* (28); *s. n.* (29).
Rijgersmaa, H. E. *s.n.* (4).
Riley, L. A. M. *125* (2).
Rio de Janeiro, Jardim Botanico de *47482* (8); *21835, 27412* (14).
Ritter, —. *s. n.* (30).
Robert, A. *s. n.* (26).
Roig, J. T. *1733* (8); *65* (18); *3* (19).
Rojas, T. *175* (3).
Rose, J. N. *1575, 14032, 14622, 14680, 21920* (3); *3515, 4054* (28).
Rose, J. N., Painter, J. H., & Rose, J. S. *9305* (3).
Rose, J. N., Standley, P. C., & Russell, P. G. *14280* (3).
Ross, G. B. *s. n.* (3).
Rowlee, W. W. & H. E. *123, 124* (3).
Ruehl, V. E. *s. n.* (3).
Rugel, F. *389* (3); *751* (27).
Rusby, H. H. *2388, 2389* (8).

Sagra, R. de la *s. n.* (3); *414, 815* (19); *s. n.* (27).
Saint-Hilaire, A. de *b*^{2} *197* (23).
Salas, G. *363* (3).
Sargent, F. H. *195* (4); *522* (28).
Schiffino, J. *126, 160* (28).
Schomburgk, Robt. *891* (12).
Schott, A. *431, 851* (3); *s. n.* (4).
Sellow, F. *s. n.* (34).
Sessé, M., Mociño, J. M., et al. *5066, 5067* (3); *675, 1449* (28).
Shafer, J. A. *173, 1647, 2847, 2853, 2886, 10381, 12330, 12368, 13410* (3); *46, 2541, 2560* (4); *11887* (8); *1754* (17); *3529, 3687, 4238, 8144, 8364* (18); *72* (19); *1156, 1178, 2680, 2684* (28).
Shimek, B. & Smith, C. L. *73* (3).
Sieber, F. W. *74, 268* (4); *326* (8); *s. n.* (30).
Siefriz, —. *1010* (3).
Simmonds, H. G. *s. n.* (3).
Sintenis, P. *1194, 1195, 2806* (4); *1193, 1193 bis, 2372, 3372, 3835, 5036, 5680* (28).
Skutch, A. F. *3556* (32).
Smith, C. L. *s. n., 127, 855, 1336, 6018* (3).
Smith, H. H. *1905, 1906* (2); *1648, 1649, 1654, 2097* (3).
Smith, H. H. & G. W. *557* (4).
Solis, A. M. *10641* (3).
Soukup, J. *4198* (3).
Spruce, R. *1837, 1896, 3821* (12); *1732, 3856* (13).
Srivatsava, G. S. s. n. (3).
Standish, M. *s. n.* (3).
Standley, P. C. *s. n., 1304, 3896, 8078, 8655, 8490, 9376, 11306, 11396, 14200, 18186, 18374, 20402, 20601, 20783, 20981, 20765, 20219, 21309, 21935, 21761, 19529, 22558, 23440, 25546, 27100, 27851, 30471, 64227, 66786, 68829, 72027, 73654, 75129, 75990, 78703, 78858* (3); *20910, 20996, 64198* (8).
Standley, P. C. & Chacou, —. *5351* (3).
Standley, P. C. & Padilla, Y. *3033* (3).
Standley, P. C. & Valerio, R. *46663, 466689* (3).
Stanford, L. R. *6938* (3).
Steere, W. C. *1104* (3).
Steggerda, M. *16* (3).
Stehle, H. *951, 981* (4); *702* (30).
Stehle, H. & M. *6164, 6994, 7002* (4).
Steinbach, J. *6536, 6561* (33).
Stevens, J. L. *6318* (28).
Stevenson, J. A. *522, 1872* (28).
Steyermark, J. A. *29489, 47717, 37825, 50757, 51431, 56218* (3); *55855, 62789* (4); *47806* (8); *60022* (10); *57428* (27).
Stork, H. E. *528, 3397* (3).

Stork, H. E., & Eyerdam, W. J., & Beetle, A. A. *8732* (3).
Stork, H. E. & Horton, O. B. *8606* (3).
Suringar, W. E. R. *s. n.* (4).
Swartz, O. *s. n.* (3); *s. n.* (28).

Tamayo, F. T. *314* (3); *197* (8).
Taylor, N. *449* (28).
Tejira, E. *13* (4).
Tessmann, G. *5107* (13).
Thiebaut, —. *1223* (3).
Thompson, J. B. *284, 298* (4); *98, 803, 876* (28).
Tonduz, A. *13916, 13940* (3).
Triana, J. J. *s. n.* (3).
Trinidad Bot. Garden *3570* (3); *2772* (8); *1931* (28).
Tucker, —. *949* (8).

Ule, E. *6805* (3); *7114* (9); *5174* (15); *6256* (33).
Underwood, L. M. & Earle, F. S. *130* (3).
Underwood, L. M. & Griggs, R. F. *628* (4); *460, 599* (28).

Vahl, M. *5209* (28).
Valerio, R. *230, 1241, 2320, 2399* (3).
Valeur, E. J. *678* (28).
Van Hermann, H. A. *706, 908* (3); *673* (8); *s. n.* (19).
Velasco, L. V. *9006* (3).
Venturi, S. *9634* (20).
Vines, R. A. *3326* (3).
Vogel, P. C. *1395* (4); *1455* (8).
Von Jacquemont *s. n.* (3).
Von Türckheim, H. *1385 bis, 2692, 2831, 3485* (28).

Wawra, H. *89* (3).
Weberbauer, A. *7112* (21).
Weddell, H. A. von *2966* (26).
Weir, J. *173* (34).
West, J. *3515* (3).
White, G. *120* (2).
White, P. *130, 137* (2).
Williams, L. O. *11189, 14070* (3); *10170* (4).
Williams, L. O. & Molina, A. *12470, 13266, 14680, 16760* (3).
Wilson, P. *1369* (3); *1345* (8).
Woodson, R. E., Allen, P. H., & Seibert, R. J. *1530* (3).
Woodward, E. F. *s. n.* (3).
Wright, C. *2942, s. n.* (3); *2943, 2944* (8); *1386, 2946* (18); *2947* (19); *s. n., 397, 400, 1383, 1384*[a] (28).
Wright, C., Perry, C. C., & Brummel, H. *219, 407* (28).
Wüllschaegel, H. R. *342* (4).
Wydler, H. *290* (28).

Xavier, L. *103* (28).

Yuncker, T. G., et al. *8078, 8655* (3).

Zaandam, —. *6885* (14).
Zainum, J. B., Molina, A., & Barkley, F. A. *B.O.115* (8).
Zanna Gutia, —. *5272* (3).

Enumeration of the Species

Section I. Rauvolfia
Series 1. tetraphyllae
1. *woodsoniana* Standl.
2. *littoralis* Rusby
3. *tetraphylla* L.
4. *viridis* R. & S.
5. *moricandii* A. DC.
Series 2. ternifoliae
6. *blanchetii* A. DC.
7. *mollis* S. Moore
8. *ligustrina* R. & S.
Section II. Macrovolfia
Series 3. latifoliae
9. *mattfeldiana* Mgf.
10. *pachyphylla* Mgf.
11. *leptophylla* A. S. Rao
12. *polyphylla* Benth.
13. *sprucei* Muel.-Arg.
14. *paraensis* Ducke
15. *macrantha* K. Sch.
16. *pentaphylla* Ducke
Series 4. angustifoliae
subseries 1. cubanae
17. *linearifolia* Brit. & Wils.
18. *salicifolia* Griseb.
19. *cubana* A. DC.
subseries 2. andinae
20. *schueli* Speg.
21. *andina* Mgf.
subseries 3. grandiflorae
22. *sanctorum* Woodson
23. *grandiflora* Mart.
24. *paucifolia* A. DC.
25. *sessilifolia* S. Moore
26. *weddelliana* Muel.-Arg.
27. *steyermarkii* Woodson
28. *nitida* Jacq.
29. *bahiensis* A. DC.
30. *biauriculata* Muel.-Arg.
31. *purpurascens* Standl.
32. *sarapiquensis* Woodson
33. *praecox* K. Sch.
34. *sellowii* Muel.-Arg.

Systematic Index

Roman type indicates accepted, preëxisting names; *italics* indicates synonoms; ***bold face*** indicates novelties; subgeneric categories are in CAPITALS.

ADDENDUM: To the list of "Dubious Species" on p. 346 add:
Rauvolfia brasiliensis Spreng. Syst. 1:834. 1825. Due to insufficient description, both A. DeCandolle and Mueller-Argoviensis have also treated this as a dubious species.

EXPLANATION OF PLATE 3

Historical illustrations of *Rauvolfia* (see page 255)

Fig. 1. *Plate 236* from Burmann's edition of Plumier's 'Plant. Amer. Gen.' 1755.

Fig. 2. Illustration of *R. tomentosa* from Jacquin (Obs. Bot. *pl. 36.* 1763).

Fig. 3. Ehret's drawing of a plant in the Chelsea Garden on which Linnaeus based his *R. tetraphylla.*

Fig. 4. Patrick Browne's illustration of *R. canescens* in the Linnean Herbarium.